

Creating a Payment for Ecosystem Services (PES) Program
Focused on Soil Health in Vermont:
Program Design Issues and Recommendations

Prepared for:

Vermont Payment for Ecosystem Services and Soil Health Working Group

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This report is the primary output from Task 8 of the project titled *Research Technical Services for the Payment for Ecosystem Services and Soil Health Working Group* which is implemented by the Gund Institute at the University of Vermont in collaboration with Conservation Performance LLC. Questions or comments on this report can be directed to Dr. Jon Winsten at Winsten.VT@gmail.com.

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Executive Summary

This report is an assessment of program design issues related to a payment for ecosystem services (PES) program focused on soil health in Vermont. The many decisions needed to create this program are to be made by the Vermont Payment for Ecosystem Services and Soil Health Working Group. As such, this document was designed to provide some context for designing an outcome-based soil health PES program, highlight important program design criteria, and discuss specific program design issues that will need to be addressed by the Working Group.

Payment for ecosystem services programs are a way to reward farmers for taking actions that benefit the environment and society and are an increasingly common alternative to regulations, when appropriate. An outcome-based PES program pays for some type of quantified outcome, as opposed to paying for the implementation of one or more specific practices. The advantages of an outcome-based program include more flexibility for farmers which can lead to innovation and greater cost-effectiveness, as well as a stronger link with the ultimate environmental goals of the program. The primary challenges of an outcome-based program include designing an appropriate quantification and verification system and preventing the program's transaction costs from outweighing its benefits.

Focusing the PES program on soil health is a unique and potentially valuable approach. Soil health is not an ecosystem service but is a necessary condition (and therefore a proxy) for several ecosystem services. There are at least two important advantages of focusing on soil health. First and foremost, improvements in soil health can increase soil productivity and farm profitability. As such, the field management changes motivated by the PES program are much more likely to be maintained even if the program ceases to exist in the future. Second, soil health is a function of variables that can be measured relatively easily and, as such, does not depend on computer simulation modeling, as does nutrient loss or greenhouse gas (GHG) emissions. On the other hand, soil health is not a direct and certain measure of the ecosystem services that we hope will result from it, such as carbon storage, water retention, flood resilience, etc. In the absence of sufficient science, we are forced to assume that these ecosystem services, the public goods the program is primarily investing in, will result from improvements in soil health.

This report makes the case that clear and explicit program goals and objectives are essential and will greatly facilitate decision-making for the plethora of issues that the Working Group will have to address. The criteria for designing a successful PES program include cost-effectiveness, financial feasibility, practicality of implementation, program compatibility, and transparency. Each of these are discussed in the report and it will be up to the Working Group to prioritize their criteria.

In this report numerous specific program design issues are assessed. For each issue, the report provides background and context, input from the Working Group, including survey results, and, where appropriate, some recommendations. A summary of the conclusions and recommendations is shown below.

Participant eligibility

- Eligibility should be open to all Vermont farms as defined in Section 3.1 of the Required Agricultural Practices Rule. However, the Working Group will need to decide:
 - If managed forest land, including sugaring operations and Christmas trees, should be excluded; and
 - If only certain geographic areas of the state or certain types of farms will be eligible based on available resources for the PES program.
- Farms should be allowed to enroll individual fields in the program and not be required to enroll their entire farming operation. However, the Working Group may want to consider requiring whole farm enrollment over time.

Quantification

- A modification of the Cornell Comprehensive Assessment of Soil Health (CASH) test may be the best option for quantifying soil health for this program. A committee of Vermont soil scientists and others will be needed to create the appropriate modifications, as described in this report, and the Task 1 Report.
- The CASH test is based on representative soil sampling from each field. Conducting soil sampling when fields are enrolled and then every three (3) years seems like an appropriate frequency to balance program costs with data richness.
- We strongly recommend that the Working Group devotes sufficient time to achieving a consensus on the issue of if and how to include biodiversity in the PES program or, at least, trying to reconcile the different viewpoints on this issue among Working Group members. A decision on this issue is essential before continuing program design efforts.

Payment Structure and Rates

- A hybrid payment structure in which farmers could earn a payment for (1) measured improvements in soil health from their farm's baseline, or (2) having a soil health score that is equal to or greater than a stated threshold may be the best way to incorporate fairness and additionality.
- Determining payment rates should consider both the costs to farmers and benefits to society of improved soil health.
- A public recognition component for farms that achieve the highest threshold of soil health should be considered. Such farmers could be recognized as "soil health heroes" and signage placed on the farm could indicate the resulting public benefits.

Monitoring and Verification

- If the program budget allows for it, it may be valuable to have the program cover the cost of third-party soil sampling for all participating farmers. This could increase farmer participation and result in more representative and consistent soil samples.
- It is probably not worthwhile to monitor practices on participating farms, since the program is most likely going to focus on the soil health score and not on the practices used. However, it may be valuable to make it very easy for farmers to report their practices on each field so they can be correlated with soil health scores on various types of soil.

Introduction

This report on program design issues and considerations for a soil health payment for ecosystem services (PES) program in Vermont is the primary deliverable from Task 8 of the project titled *Research Technical Services for the Payment for Ecosystem Services and Soil Health Working Group*. The intention of Task 8 (and this report) is to provide useful information to the Vermont Payment for Ecosystem Services and Soil Health Working Group (referred to in this report as “the Working Group”) that can further their mission to design such a program.

This report starts with a discussion of the PES approach and clarifies the distinction between a focus on practices versus outcomes. This is followed by addressing the question of why focus on soil health. A short section then emphasizes the importance of clear and explicit goals and objectives. Some of the more important program design criteria are discussed next. This sets up an assessment of the specific, major program design issues to be considered by the Working Group. The report ends with a brief discussion of suggested next steps for the Working Group. The conclusions and a summary of the recommendations are contained in the Executive Summary at the beginning of the report and are not repeated at the end.

A set of three surveys solicited input from working group members on program design issues between December 2021 and February 2022. Survey results are incorporated throughout this report in subsections titled “Working Group Input”. The verbatim responses to open ended questions from the surveys are shown in Appendix 1.

What is a Payment for Ecosystem Services (PES) Program?

Ecosystem services are the benefits to society that emerge from nature, including managed landscapes. There are many different forms of ecosystem services, but they are generally categorized as either being regulating, provisioning, supporting, or cultural. There is a plethora of information about ecosystem services in the scientific literature, as it has been an important concept in conservation over the past 25 years, including work emanating from UVM’s Gund Institute.

In a nutshell, ecosystem services are essential to address some of the most pressing environmental problems of our time, including climate change and water quality degradation. For example, carbon sequestration is crucially important to help to mitigate global climate change and the soil’s ability to allow water infiltration and holding capacity is crucial to improve resilience to flooding and drought. Agriculture, because it covers such a large amount of land, is inextricably linked to these and other important environmental issues. However, a farmer’s decision-making will most often not take these environmental consequences fully into account because the impacts and their associated costs rarely affect the farmer directly and exclusively. Rather, the costs are borne by people nearby, downstream, or globally. Such consequences are considered to be “external” to the decision-making process of the farmer and can be referred to as environmental externalities.

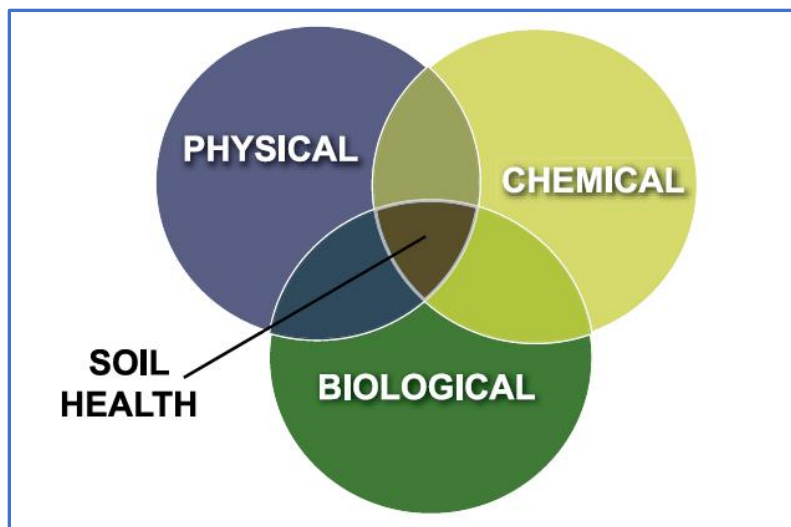
One way of addressing environmental externalities is with regulations. However, regulations on farming tend to be prescriptive, will often constrain farm profitability, and can be politically unpalatable. An alternative approach that is gaining increasing attention in the policy world is the concept of payments for ecosystem services (PES). The idea behind PES is to offer payments that motivate farmers to

voluntarily make decisions that help to reduce specific environmental externalities resulting, in part, from their farming activities.

Payment for ecosystem services programs can pay for the implementation of specific farming practices (or the reduction thereof) or they can pay for specific outcomes. Paying for practices is generally easier to design and implement but paying for outcomes can be more effective and cost-effective. For example, paying for science-based reductions (i.e. measured or modeled) in nutrient loss from a farm's fields rather than paying farmers to implement one or more practices provides greater confidence in the environmental impact of a program. Further, paying for outcomes gives farmers more flexibility to achieve the outcome in a cost-effective manner, which can improve the overall cost-effectiveness of the program. However, designing a successful outcome-based PES program can be a complicated task. This report provides some description, assessment, and where appropriate, some recommendations for developing an outcome-based PES program focused on the improvement of in-field soil health on Vermont farms, as this is the charge of the Working Group.

There have been hundreds of PES programs implemented or tested throughout the world over the past 20 years. Salzman et al. (2018) reported that in 2018 there were 550 active PES programs with cumulative annual payments of over \$36 billion. The focus of these programs varies, but generally fall into the following categories: water, carbon, and biodiversity (Salzman et al. 2018). A quick literature search did not reveal evidence of PES programs (current or past) that focus explicitly on soil health. Soil health is not an ecosystem service, but higher levels of soil health have the ability to contribute to several important ecosystem services, including climate regulation, climate adaptation, flood mitigation, resilience to drought, and improved water quality.

*Figure 1. Venn diagram indicating the major facets of soil health.
Source: CASH Manual; adapted from Rodale Institute.*



Why Focus on Soil Health?

As can be seen in the Figure 1, soil health is found at that intersection of optimized levels of chemical, physical, and biological aspects of the soil. The increasing focus within the conservation community on soil health in recent years seems to have significant merit. What distinguishes the focus on soil health from previous conservation approaches is that improved soil

health has the potential to both produce a set of important ecosystem services and improve productivity and profits for the farm. If the farm becomes more productive, food security is improved. If the farm becomes more profitable through improved soil health, the field management changes that resulted in the improved soil health are not likely to be reversed if the PES program payments cease in

the future. Conversely, if conservation field management changes reduce a farm's profitability, they are at risk of being reversed once the conservation program ends.

According to the USDA Natural Resources Conservation Service there are four primary principles to manage land for soil health¹; these include (1) maximize the presence of living roots in the soil, (2) minimize soil disturbance, (3) maximize soil cover, and (4) maximize biodiversity. This report will not attempt to describe the intricacies of soil health or the many ways that it can be improved by Vermont farmers. For further reading on this subject there are numerous books, papers and reports available; a couple of relevant resources include Moebius-Clune et al. (2016) and Magdoff and van Es (2009).

The important aspects, relevant to this report, to understand are that there are many ways to improve soil health and that multiple field management practices are most likely required simultaneously. It has been proposed that there is a soil health "tipping point", which refers to the idea that once a critical threshold of soil health is reached, the rate of increased productivity also increases. Unfortunately, scientific research on this hypothesis is not evident in the scientific literature nor is information on that critical threshold clear or specific. There is some anecdotal evidence that simultaneous implementation of soil management practices in ways that adhere to the soil health principles can greatly increase farm profitability².

Program Goals and Objectives

In the design of any program, it is very helpful to have clearly stated and descriptive goals and objectives to start from. Inevitably there are difficult decisions that need to be made; decisions are facilitated by asking how each choice is likely to help achieve the program goals.

The Working Group was created by the Vermont Secretary of Agriculture as authorized in Act 83 of 2019. The announcement of the Working Group states:

"The purpose of this Working Group is to recommend financial incentives designed to encourage farmers in Vermont to implement agricultural practices that improve soil health, enhance crop resilience, increase carbon storage and stormwater storage capacity, and reduce agricultural runoff to waters."

We encourage the Working Group to get even more specific with their goals for this program, as that will undoubtedly help the group to make important decisions necessary to design a successful program.

Program Design Criteria

Before discussing specific program design issues in the following section, it is worthwhile to consider some of the important program design criteria. The Working Group should give serious consideration to which criteria they feel are most important for the design of this PES program. Similar to the goals and objectives, having clarity on the relative importance of these criteria can greatly facilitate the group's decision-making process. The criteria discussed below are not an exhaustive list but are some of the more important ones to consider.

¹ These can be found at the following NRCS website:

<https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/soils/health/?cid=stelprdb1048783>

² See interview with Rick Clark at <https://regenfarming.news/articles/1348-us-farmer-interview-rick-clark>

Cost-effectiveness and Efficiency

Regarding policy or program evaluation, these two concepts are similar but have different definitions. Cost-effectiveness is defined as achieving a given outcome with minimum cost. Efficiency is defined as maximizing the net benefits of the program, which is the total benefit minus the total cost. These definitions imply that a program can be cost-effective but not be efficient. The given level of outcome that is reached in a cost-effective manner (i.e. at minimum cost), may not be the level of outcome that results in the greatest net benefit to society. However, if a program maximizes efficiency, it will also be cost-effective. A program may need to achieve economies of scale in order to be efficient.

For the purposes of this report and the decisions in front of the Working Group, cost-effectiveness is a more relevant concept to consider in the near term. Outcome-based programs can have significant transaction costs (i.e. the costs incurred to allow the outcome-based payment to happen). Therefore, thinking about ways to reduce transaction costs will help to increase cost-effectiveness. Also, creating a payment structure and setting appropriate payment levels are crucial decisions that will affect the program's cost-effectiveness.

Cost-effectiveness has most meaning in a relative context; how would this program compare to other conservation programs? In order to have a measure of cost-effectiveness, one needs to know the technical effectiveness (i.e. outcome) produced by the program. Unfortunately, the vast majority of conservation programs are practice-based and do not quantify the outcomes produced. Therefore, comparing cost-effectiveness relative to programs such as EQIP, CSP, CRP, and CREP is not possible. Regardless, the designers and implementers of this PES program have a responsibility to attempt to maximize both cost-effectiveness and efficiency, at least within the confines of the larger program goals.

The issue of cost-effectiveness versus fairness is very important to consider. The Working Group has been very clear that it wants a program that does not disadvantage farmers who have already been making efforts to improve soil health and/or be excellent land stewards and conservationists. Therefore, the payment structure (discussed in the section on specific design criteria) is likely to include payments for existing high levels of soil health, as opposed to payments only for improvements in soil health (i.e. additionality). The latter would be more cost-effective, but the former is more fair.

There are several other important issues to consider regarding the program's cost-effectiveness which are related to the factors of human motivation. Motivation is defined as the act of goal-setting behavior. Humans generally have a drive to achieve clearly defined goals. Most of our federal and state conservation programs do not have such goals and have not been able to fully motivate large segments of the farm community. Three important features of goals include: specificity (clear and well-defined), appropriate difficulty (not too easy or too hard to achieve), and proximity (achievable in the not too distant future). Such goal-related features will need to be considered in determining the soil health thresholds that receive program payments.

The more flexibility that farmers have to achieve the goal, the more likely that they will be able to find ways that are least costly to do so. Flexibility can also harness the innovative capacity and problem-solving skills that farmers tend to be so good at; this can help to reduce total program costs.

A healthy amount of competition can motivate farmers to try to further increase their effectiveness (i.e. further improvements in soil health). Farmers, like all people, are interested to see how good their performance can get (i.e. part of intrinsic motivation), as well as if they can outperform other farmers

(i.e. part of extrinsic motivation). Greater effectiveness, if it can be accomplished with less than proportional increase in costs, will increase cost-effectiveness.

Lastly, scale (i.e. farm size) can play an important role in cost-effectiveness. Larger farms may be able to achieve more cost-effective outcomes, although this is not necessarily the case. The Working Group may want to consider ways to ensure that smaller farms are able to fully participate in the PES program while recognizing the possible impacts on program cost-effectiveness in the face of budget constraints.

Financial Feasibility

For a program to be financially feasible the full costs of implementation and the budget constraints need to be known. Unfortunately, at the early stages of program design neither of these pieces of information are often very clear. As such, program designers need to assume that the program will face significant budget constraints and try to achieve program goals with minimum total program costs.

The three major categories of costs are program administration, payments, and quantification/verification. Program administration costs include items such as the salaries of managers and staff required to implement the program, as well as office space and supplies. The payments to farmers should be the single largest cost item and are discussed in the section on payment structure. An outcome-based program must have a way to quantify the outcomes on each participating farm. These costs can be borne by the program or by the farmers. If the latter, the program payments need to be sufficient to leave the farmer better off from their participation. Verification of outcomes is also important in PES programs. For a soil health PES program, models could be used to estimate the ecosystem services that are produced from higher levels of soil health.

Assessing financial feasibility should include estimated total annual costs, risks of cost over-runs, as well as the potential to utilize debt instruments and to generate program revenue. Estimated annual costs should include all costs in the categories described in the previous paragraph, but some costs can be estimated with more certainty and precision than can other costs, such as program payments, which depend on the level of participation and effort by farmers. The ability to use subsidized loans to help implement a program that creates public goods (i.e. ecosystem services) may be possible, but that may require program revenue to repay. It is possible that credits for carbon offsets or water quality could be generated and sold to create program revenue. This is discussed briefly in the Program Administration section later in this report.

Feasibility of Implementation

Effective implementation is necessary to attain program goals. The program director or management team needs to have a feasible workplan that results in achieving program goals and they need the authority to make executive decisions required to keep the program on track. The program staff need to be well-qualified for their jobs and the program needs to be timely in its response to participants. Unfortunately, the staff who implement a program are not usually integrally involved in program design. The people who are likely to be program staff should be involved in program design; pilot-testing and adaptation should be considered part of the design process. Pilot-testing is the only way to adequately understand implementation problems and bottlenecks.

It is important that the implementation process does not end up obscuring the program's goals and objectives. For example, underestimating the amount of staff time required to process the information of each participating farm will either reduce the number of farmers who can participate or greatly

increase the workload of the staff to the point where corners are being cut to save time. This can undermine the integrity of the quantification process and the reputation of the program.

The capability and enthusiasm of the staff in the administering agency is key for successful program implementation. Ideally, the program has one or more “champions” within the agency or entity. If the program is viewed as a burden to the agency or its staff, the probability for successful implementation will be decreased.

Program Compatibility – Relationship to Existing Conservation Programs

There are many existing conservation programs that offer payments to farmers. Most of these are practice-based, as opposed to outcome-based, programs (see previous section on PES programs for a description of the distinction). Programs are offered by federal and state agencies, as well as conservation districts and private sector entities. As the Working Group is already aware, it will be critical to design this PES program in a way that is compatible with existing programs.

Important questions to be addressed should include, but not be limited to, the following:

- How will this program be complementary to or in competition with existing programs?
- Are payments for outcomes from this program considered a “double dip” with payments from practice-based programs, such as EQIP?
- What comparative advantage will the program have for farmers and how can that be maximized?

Agency staff responsible for related conservation programs should be part of the stakeholder group that helps to inform the design of this PES program. Fortunately, most or all such agencies are represented on the Working Group.

Specific Design Issues for a Soil Health PES Program

Effective program design and pilot-testing are essential steps for a successful PES program. A science-based process with significant stakeholder input should be used to design the program. Regardless of how sound the program design is, careful pilot-testing is also essential, because using real-world situations is how many of the important questions are revealed. There are always unique circumstances on farms and questions from participants that provide opportunities for the program design to be modified according to science and stakeholder input. Program design should not be considered complete until pilot-testing has been done.

The major program design issues assessed for this PES program include eligibility, quantification, payment structure, and monitoring and verification. Each of these are discussed in the subsections below; each subsection presents some background and context, input from the Working Group, and recommendations. That section is followed by discussion of additional issues of relevance that, although important to consider, are secondary to those in the preceding section.

Eligibility for Participating Farms

Background and Context

The two important issues related to farmer eligibility for a program that offers the potential for additional farm income include (1) managing the program within budget constraints and (2) excluding farms that have violated specific societal expectations.

The issue of budget constraints can be more complicated than one might imagine when dealing with a program that will incur uncertain payment amounts due to lack of information on many factors. The primary uncertainties include how many farmers will enroll with how many acres, current levels of soil health, and the extent of improvements in soil health that farmers will achieve. Each of these factors will impact the program's payment obligations. The program must ensure that it does not over-commit and result in payment obligations that exceed funding available for payments. For this reason, a program may decide to start with a geographical or sectoral subset to allow eligibility from. For example, rolling out the program first in one watershed or for one type of farm, such as dairy. This approach to piloting the program could help the first phase run smoothly, but could create perceptions of unfairness.

There is a steep learning curve when implementing a new program; this is especially true for an outcome-based program such as this PES approach. Starting with a smaller focus can help the program to ensure adequate or exceptional delivery and evaluation, which will help to demonstrate the potential success of the program to other farmers, legislators, and the public.

Working Group Input on Eligibility

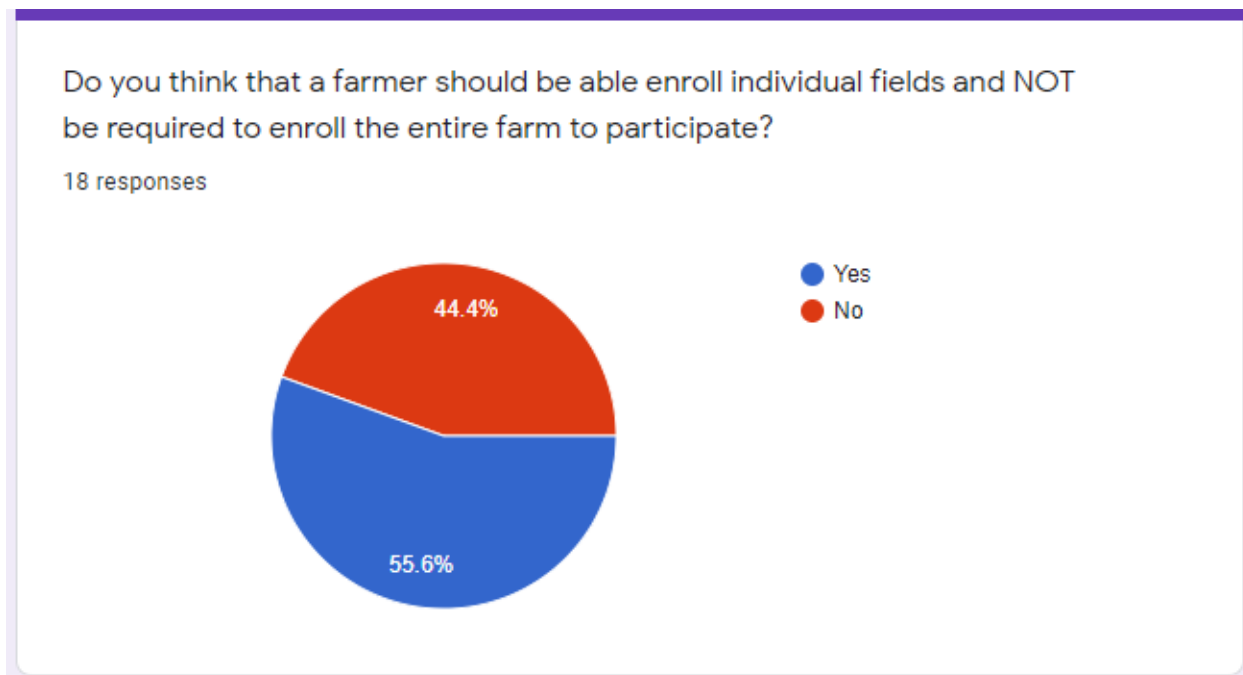
As part of the work of Task 8, we surveyed the Working Group (members and other participants) to understand their perspectives on various aspects of program design. We proposed a “strawman” program design to get the Working Group thinking about the relevant issues, including eligibility of any farm in Vermont that is registered as a commercial farm. This suggestion did not provoke any alternative suggestions. However, one respondent wondered what defines a commercial farm in Vermont. It turns out that the term “commercial” is not used by the State to define a farm. However, there is a set of criteria listed in [Section 3.1 of the Required Agricultural Practices Rule](#). These criteria can be summarized as meeting any of the following: (1) the sale of at least \$2,000 of agricultural products per year, (2) working at least 4 contiguous acres of land, (3) managing more than a certain number of livestock (varies by species), or submits a Form 1040(F) as part of their federal tax return.

Another issue related to eligibility (as well as other program design issues) is whether farmers should be able to enroll individual fields or should be required to enroll their entire farm in the program. The input from the Working Group (18 responses) related to this issue indicates that 56% of respondents think that farmers should be able to enroll individual fields and 44% think that the enrolling the whole farm should be required (Figure 2). This can be seen in the pie chart below. Based on the open-ended feedback from the Working Group, this issue seems to come down to some members preferring a holistic approach to farm management, while others feel that it will be easier for farmers to enroll and less costly for soil sampling to allow individual fields to be enrolled.

Allowing individual fields to be enrolled may help to increase farmer participation due to requiring less time and effort by the farmer. An idea that was stated by more than one member is to allow individual fields to be enrolled but require that the whole farm ultimately be enrolled within some number of years.

The Vermont Required Agricultural Practices Rule defines the important aspects of society's expectations for the minimum level of acceptable land management. Farmers who are not in compliance with the RAPs could be considered to be violating these expectations. Given that the vast majority of Vermont farms are in compliance with the RAPs, it would likely be seen as unfair to the majority to allow farms to participate in this PES program who were not in compliance with the RAPs.

Figure 2. Survey results on enrolling individual fields vs entire farm.



There were 12 responses to the open-ended question: "If you have any other input related to eligibility, please state it below." The verbatim responses are shown in Appendix I. Below are a summary of the responses:

1. Would be good to make sure that eligibility criteria excludes backyard gardeners and other non-farmers.
2. Suggestions to allow enrollment of individual fields, but have a requirement to enroll whole farm within a certain period of time.
3. Requiring enrollment of the whole farm could:
 - a. diminish experimentation and innovation because it would be too costly to do this on whole farm.
 - b. be problematic for diversified farms, as there may be parts of the farm operation for which it does not makes sense to enroll.
 - c. be more consistent with a holistic approach to management and that may be a desirable outcome.
4. The CSP+ proposal (which was presented to the Working Group as a path forward) focuses on comprehensive planning with the help of technical service providers (TSPs); it may be okay to enroll just some fields if the whole farm is being considered in the planning process.
5. The Glastir program (Wales) which was reviewed as part of Task 6 of this project requires that all land enrolled in the program be under full management control of the enrolling farmer for at

least the duration of the program contract (5 years). This requires tenants to prove their control of rented fields to be enrolled.

6. At least one respondent was concerned with the potential for “leakage” without whole farm enrollment. Leakage is when improvement is made on one parcel but is partly or wholly negated by detrimental management other parcels.
7. There were concerns that requiring whole farm enrollment could reduce potential participation.

Recommendations on Eligibility

1. All farms in the State of Vermont should be eligible to participate, provided that they are compliant with the Required Agricultural Practices and in good standing with the State.
 - a. The working group should consider whether the eligibility of forest land should be excluded. It seems that a sugaring operation would meet the definition of a farm by the State. However, sugaring operations could result in very large program payments which do not provide “additional” ecosystem services.
2. Individual fields should be able to be enrolled, at least initially, in order to increase farmer participation. Encouraging or requiring whole farm enrollment over time could be considered. The Working Group would need to decide if and how woodlots, sugarbushes and other non-field parts of the farm were included in the program. It seems that soil health in these areas would be on a different scale than in-field soil health and may be better to exclude them from the program.

Quantification of Soil Health

Background and Context

Soil health is complex and there are many (i.e. dozens or scores) metrics that are used in combination to define soil health. There are several possible approaches to gauge soil health, including soil measurement (i.e. sampling and analysis), simulation modeling, or an approach based on the field management practices used over time. For many PES-type programs, a measurement approach is not practical. A pertinent example for Vermont is the new Pay-for-Phosphorus program which pays farmers for modeled reductions in phosphorus (P) loss from their fields. To measure P loss, which is very diffuse across the landscape, would require monitoring equipment that is far too costly to justify on a per field or per enrolled farm basis. Most existing conservation programs are practice-based; experimental outcome-based programs most often use simulation modeling.

Although it may be more practical and cost effective in some cases, modeling can be problematic for several reasons. First, the models may have inadequate accuracy, high level of uncertainty, or insufficient precision in estimating the environmental outcome (e.g. P loss from any given field). This can undermine the ultimate environmental outcomes of the program, as well as confidence in the program. Second, the flexibility of the farmer to affect the outcome is limited by the types of practices that are built into the model. Third, running most models can take a lot of time and data, which can drive up the transaction costs of the program.

COMET-Farm is a well developed modeling tool that can estimate carbon sequestration and greenhouse gas emissions outcomes for PES programs. However, COMET-Farm does not model other soil health parameters or other ecosystem services beyond climate regulation. To our knowledge, an appropriate

model does not exist which captures indicators of all the ecosystem services of interest to the Working Group.

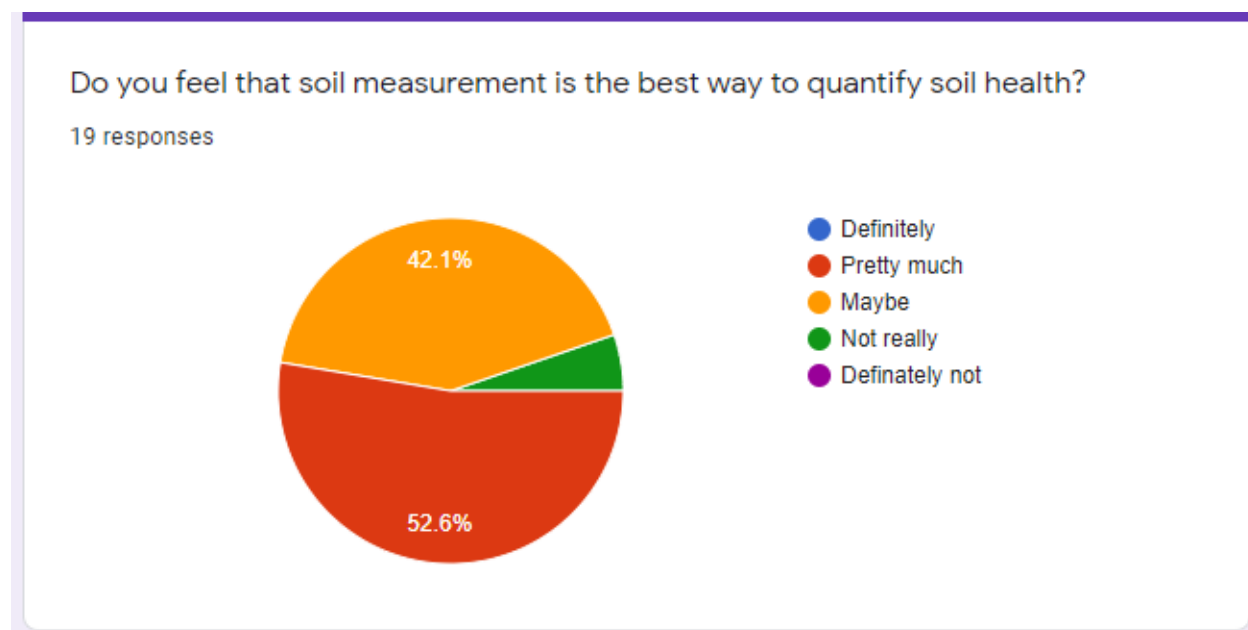
The PES program under development, with a focus on soil health, has the potential to use a measurement approach to quantification because it may not necessarily be prohibitively expensive to secure adequate soil samples and perform the necessary analyses on them. Measurement may drive transaction costs, and overall program costs, but the measurement approach creates almost unlimited flexibility for participating farmers to try to achieve desired outcomes. An important exception would be if farmers use soil amendments that are considered to be undesirable and/or detrimental to increase their soil health scores; specific program rules would need to be developed and made clear to participants.

It should be noted, as discussed earlier, that soil health is really a proxy for the ecosystem services desired by the public. However, for the farmer, soil health has tangible private benefits which can increase net farm income. Ideally, the incentive payments motivate farmers to make changes to improve soil health and the private benefits are what prevents farmers from reverting those changes if the program ends.

Working Group Input on Quantification

The survey results from the Working Group indicate that a slim majority (53%) feel that soil measurement is “pretty much” the best way to quantify soil health, with most of the remainder of respondents indicating “maybe” (Figure 3). No respondents indicated “definitely” nor “definitely not” and few responded, “probably not”. This indicates that soil measurement may be the best path forward, but that more information and education on the quantification options may be necessary.

Figure 3. Survey results on soil measurement.



There were 13 responses to the open-ended question: “If you have other suggestions for how to quantify soil health, please explain them below. Other options could be (1) estimating soil health based

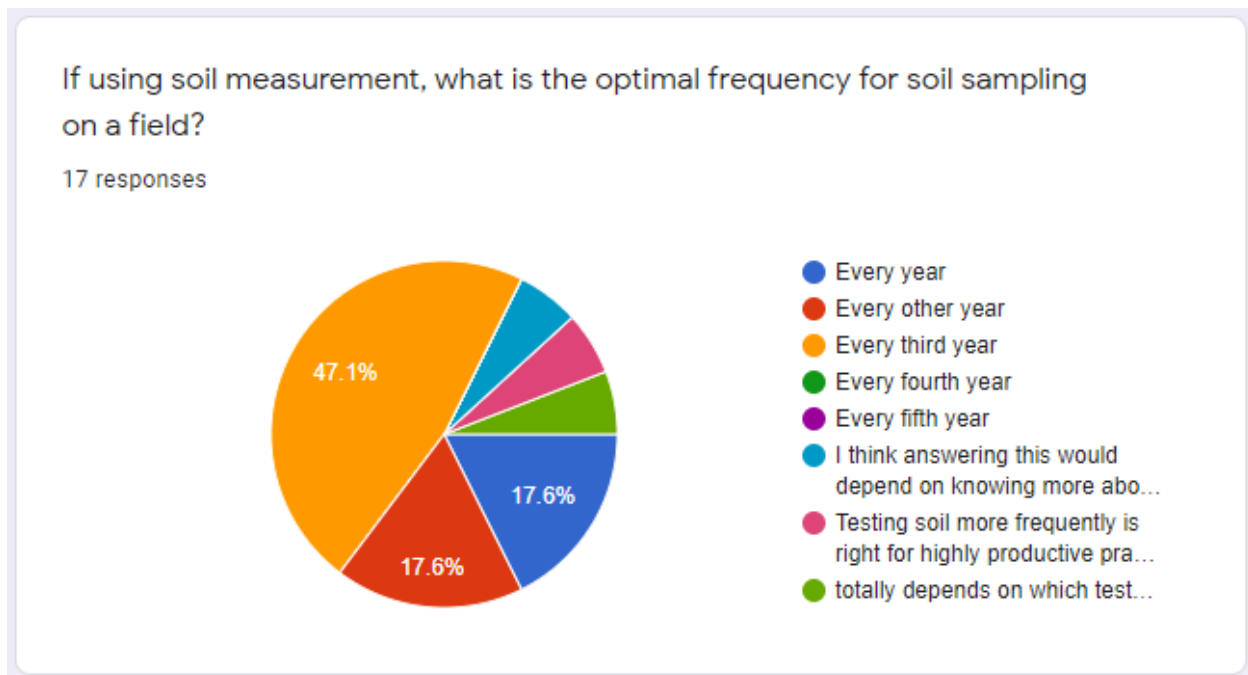
on field management practices or (2) some type of simulation modeling.” The verbatim responses are shown in Appendix I. Below are a summary of the responses:

1. Many respondents indicate that soil measurement is their preferred approach; saying that they think it is simple and straight-forward but need to be aware of the time lag between field management changes and measurable changes in soil health.
2. Should prioritize measures that farmers can accurately and affordably do on their own, including observations. There are on-farm observations that are results of soil health, such as yields, produce quality, herd health, biodiversity, etc. that could be used.
3. Would like to see more of a holistic quantification that includes biodiversity, water infiltration and holding capacity, wetlands, pests and pathogens, reduced runoff, erosion, and off-farm inputs.
4. Would like to see a combination of soil measurement (including deeper than 30cm), as well as a focus on practices, possibly with some modeling. One response indicates that more than just soil measurement may be needed to be able to tell the full story of the ES being produced.
5. Several respondents indicate that monitoring the quality and quantity of practices is important and perhaps a better approach to quantification for this program. It was said that:
 - Monitoring practices is already being done for other efforts, so this may be an easy way to quantify soil health.
 - Practices may be a good way to get payments to farmers sooner than waiting for measured soil health to change.
 - Measured results could be used to trigger augmented payments.

If soil measurement were going to be used, almost half of the respondents (47%) think that soil sampling every third year would be optimal (Figure 4). About 18% each think that every other year or every year is preferable. The survey results from this question can be seen below. The more frequent the soil sampling, the more information is gathered and the more costs are incurred by the program. However, the important questions from a program design perspective include:

- Will the additional information, given that changes in the soil can be slow, be worth the additional cost of more frequent sampling and analysis?
- Will more frequent soil sampling requirements reduce the participation rate by Vermont farmers?
- Will less frequent measurement adequately account for interannual variability in soil measurements?

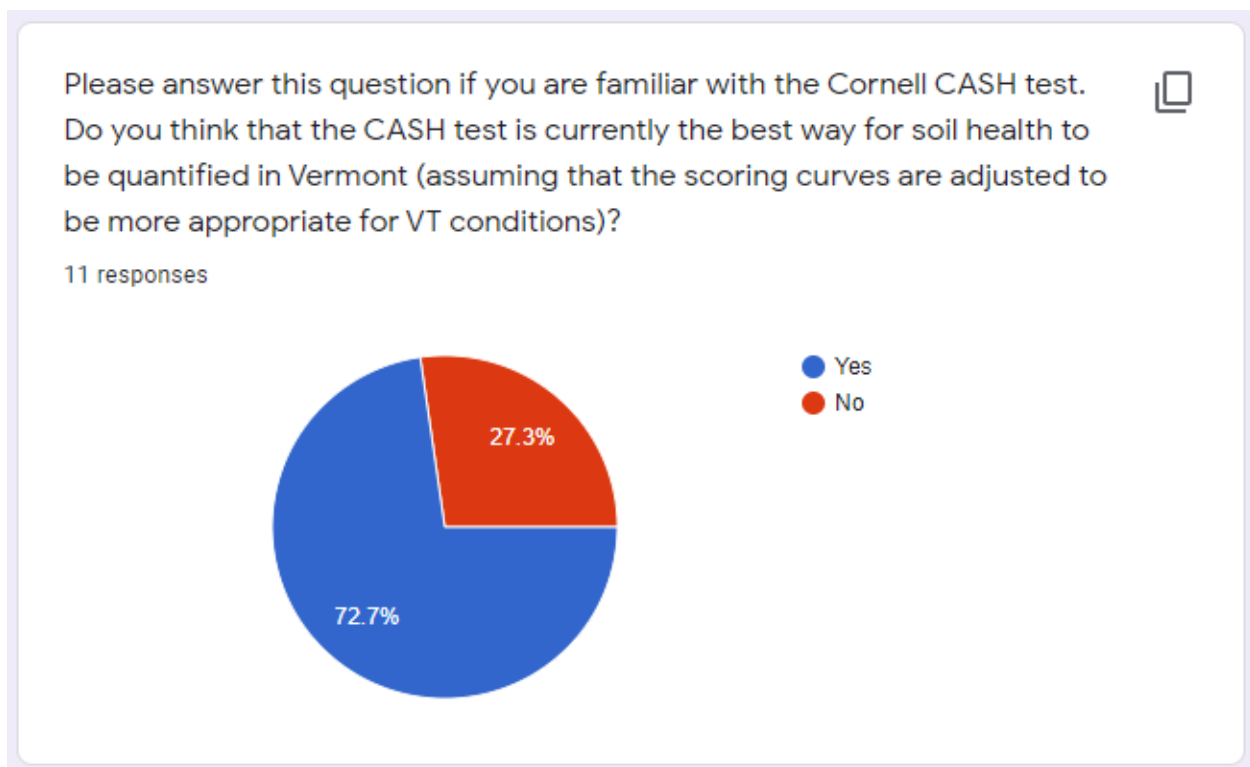
Figure 4. Survey results on optimal frequency for soil sampling.



Information on the Cornell Comprehensive Assessment of Soil Health (CASH) test was presented to the Working Group in 2021. The CASH test is a tool that has been developed by Cornell scientists and others over the past 10+ years to help farmers and researchers quantify soil health. It has been used recently in Vermont as part of the Vermont State of Soil Health project and the Vermont Environmental Stewardship Program (VESP). This has revealed a need to modify the scoring system to make the CASH test more useful in Vermont. The survey asked respondents to indicate if they thought that the CASH test, provided that they were familiar with it, was the best way to quantify soil health. Almost 73% of respondents indicated yes and 27% indicated no. This tool is discussed in more detail in the following subsection (Figure 5).

It is important to note that the CASH test was not developed for the purposes of an incentive program. It was developed as an educational tool for farmers to understand soil health on their fields. Hence, there are several important modifications to the CASH test that would be necessary for use as a quantification tool in an incentive program. These are also discussed in the next section.

Figure 5. Survey results on use of CASH test.



The Cornell Comprehensive Assessment of Soil Health and Its Use in Vermont

The CASH test, as described above, is a comprehensive soil analysis consisting of many metrics related to the physical, chemical, and biological properties of the soil. More information, including the full manual describing the background and metrics can be found [here](#).

There were 10 responses to the open-ended question “Are there other tools or means for quantifying soil health that you want to suggest? Please explain your suggestion with some details.” The verbatim responses are shown in Appendix I. Below are a summary of the responses:

1. Several respondents indicate that they think the CASH test, with necessary modifications, is the best approach to quantification.
2. Several respondents emphasize the importance of including biodiversity at several levels, as well as other landscape functions such as water infiltration and those provided by wetlands.
3. It was suggested that there are observations and proxy measures, such as habitat, soil armor, paddock rest periods for grazing systems, and presence of trees and shrubs that should be considered as part of the quantification system.

Working Group Input on Biodiversity

The inclusion of biodiversity metrics in this program may be the most difficult issue that the Working Group has to navigate currently. Our team issued a survey on this subject to collect thoughts and input from the Working Group and the interested observers. There were a total of 14 responses; the results are summarized below.

There are contrasting opinions regarding what the intentions of the Working Group are with regard to biodiversity. The Working Group leadership has indicated that if any biodiversity metrics are to be included, that they should be within the soil. Alternatively, some members of the Working Group have expressed their views that broader field or landscape-level biodiversity is very important to include.

As can be seen in the chart below (Figure 6), 57% (8 respondents) indicated that including biodiversity in this PES program is “extremely important”, which equals a score of 10 on a scale of 1-10. One respondent indicated 8 and another responded 6 out of 10. Three respondents were neutral (5) and one indicated that including biodiversity is not a good idea. In terms of the types of biodiversity that Working Group members think should be included are wildlife habitat/diversity (11), plant diversity (11), soil microbial diversity (10), and soil macroinvertebrates (9) (Figure 7). The number of votes is shown and the % of respondents voting for each is shown in parentheses in the chart. There was also one vote each for these write-in answers: pollinators and root diversity.

From the open-ended question asking for further thoughts on the inclusion of biodiversity, the responses can be categorized into two major themes. One theme is the importance of overall ecological function related to farming and that associated landscape-level biodiversity needs to be included in the program. For example, one response indicates that wildlife habitat is the form of biodiversity that is most closely aligned with the mission of the Working Group and this PES program. The other theme is that the focus of the Working Group is soil health and, therefore, any biodiversity metrics should be within the soil. One response indicates that soil microbial diversity and the presence of macroinvertebrates is the type of biodiversity most closely aligned with soil health and that soil health is the stated focus on this PES program.

Figure 6. Survey results on including biodiversity in the quantification.

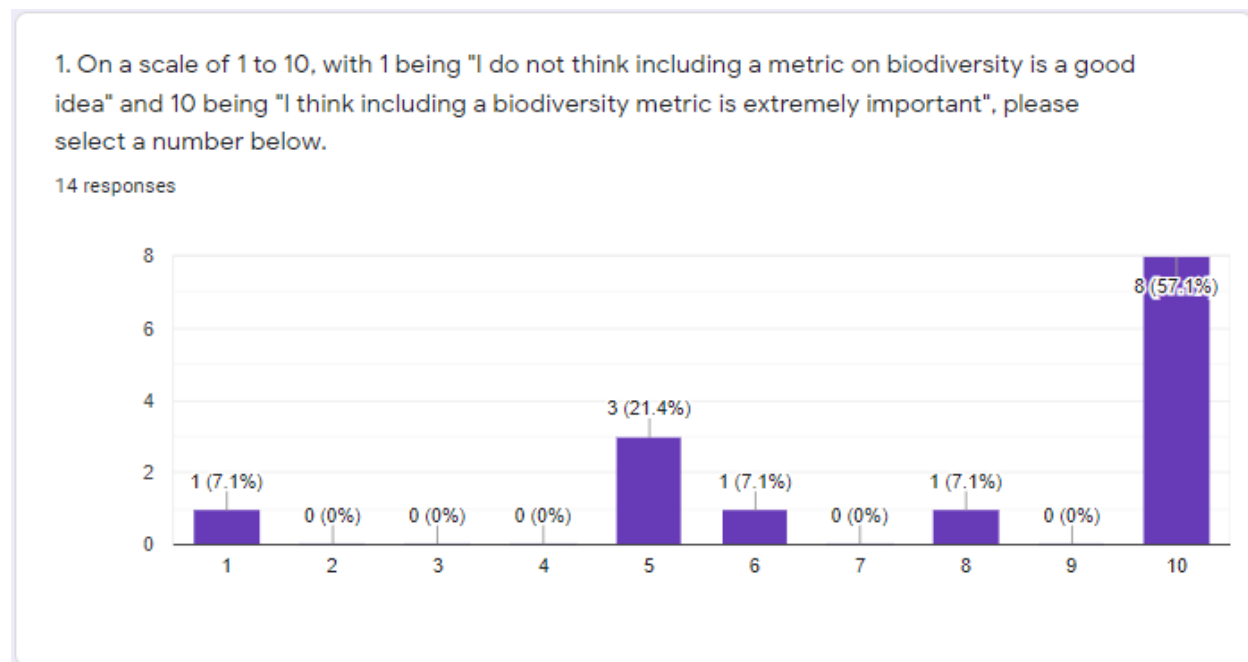
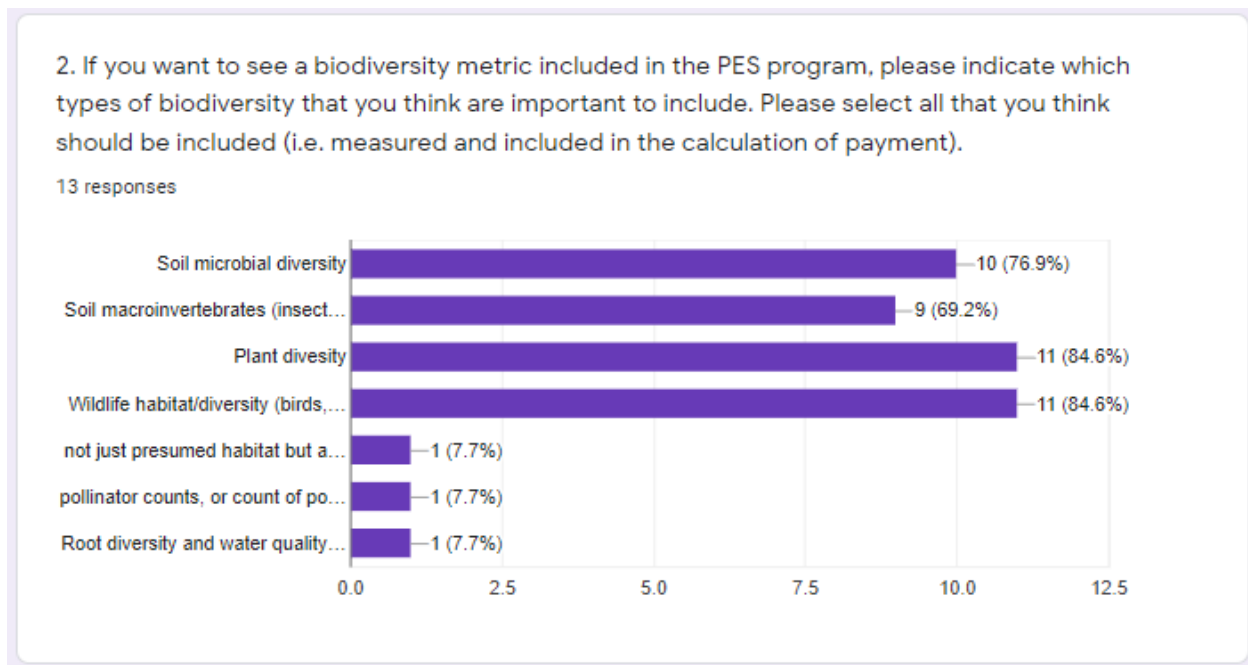


Figure 7. Survey results on the types of biodiversity metrics to include.



Recommendations on Quantification

Our recommendations on quantification for this PES program include the following:

1. The CASH test offers a structure that could be modified to be more useful in Vermont and for this PES program. The primary areas of modification that have been identified so far include:
 - a. Assess which measures that are included in the CASH test should be kept and which should be discarded or replaced with an alternative. For example, adding a lab test for soil bulk density would be much more useful than the penetrometer reading that the CASH test currently uses as a proxy for bulk density. However, the lab test would add additional cost to the quantification process; the cost-benefit ratio would need to be assessed.
 - b. Adjusting the scoring curves used in the test to be more appropriate for Vermont soils. As noted above, Vermont soils tend to score quite high on average using the CASH test. This may make it difficult to detect improvement in soil health that the PES program would like to incentivize.
 - c. Ensure that the soil types are adequately factored into scoring curves to level the playing field across farms. This issue is also related to the previous item about adjusting the scoring curves for the included measures.
 - d. The CASH test currently uses an equal weighting of all of the many measures to create a soil health score. The weighting of included measures to produce an overall soil health score should be addressed by a committee of Vermont soil scientists (see next recommendation).
 - e. A committee of Vermont soil scientists should be formed to assess the measures to include, the weighting, and the overall scoring curve with a goal of adapting the current CASH test to be most useful for the goals of this Vermont PES program.

2. Create a template for calculating a farm's weighted soil health score. Each field will have a modified CASH test score as described above. The score of each field and the respective number of acres would be used to calculate a farm's weighted soil health score. The payments could be calculated field-by-field and then summed up, but it may be simpler to create the weighted score and use that to calculate the farm's payment. Either way, each farmer should be provided with their field-specific scores, including the results of each measure within the modified CASH score. This will allow each farmer to make informed decisions on the best strategies to increase each field's score and on which fields they can most cost-effectively increase their overall farm score.
3. We strongly recommend that the Working Group devotes sufficient time to achieving a consensus on the issue of if and how to include biodiversity in the PES program or, at least, trying to reconcile the different viewpoints on this issue among Working Group members. Some further issues to consider include:
 - a. The CASH test includes a test of microbial activity, but does not include a measure of diversity. In 2021, UVM Extension initiated its first state-wide effort of soil microbial diversity analysis on farm fields using EcoPlates (produced by Biolog). If soil microbial biodiversity were to be included, the EcoPlates would be a likely candidate for quantifying this. However, at a cost of \$30 per sample and lack of evidence of correlating benefits, it is not clear that soil microbial biodiversity should be included. If this is to be pursued, we recommend that a committee of Vermont soil scientists (mentioned above) assess all feasible means for quantifying soil microbial diversity and how to appropriately weight this in an overall soil health score, or leave it out.
 - b. The inclusion of aboveground biodiversity in this soil health focused PES program will add further complexity to the program and possibly reduce the feasibility of implementation. PES programs are complicated; a key to success is to keep the program as focused and simple as possible. We encourage the Working Group to give serious consideration to how inclusion of biodiversity could impact the program's success.
 - c. If the charge of the Working Group is improved soil health, than any biodiversity measures included in this program should be closely related to soils and soil health. Soil microbial and invertebrate diversity are closely related; diversity of birds or plants on the farm are less related and may be better targets for a different incentive program.

Payment Structure: Additionality vs. Fairness

Background and Context

The issue of additionality refers to whether the incentive payment produces "additional" improvements in soil health (and by extension in ecosystem services) that are not already being delivered based on how the fields are currently being managed or would not be delivered in the absence of the payment. Some farmers have been very active conservationists for decades and other farmers have done very little conservation. For the former group there will be less opportunity for further cost-effective improvements in soil health (due in part to the law of diminishing returns). For the latter group, there may be plenty of low-hanging fruit (changes that can improve soil health with little or no additional cost). If budget constraints did not exist, additionality would not be a crucial issue.

Put another way, it is not fair for farmers who have made efforts and incurred costs to manage their fields for improved soil health to be penalized (i.e. disadvantaged) relative to farmers who have not

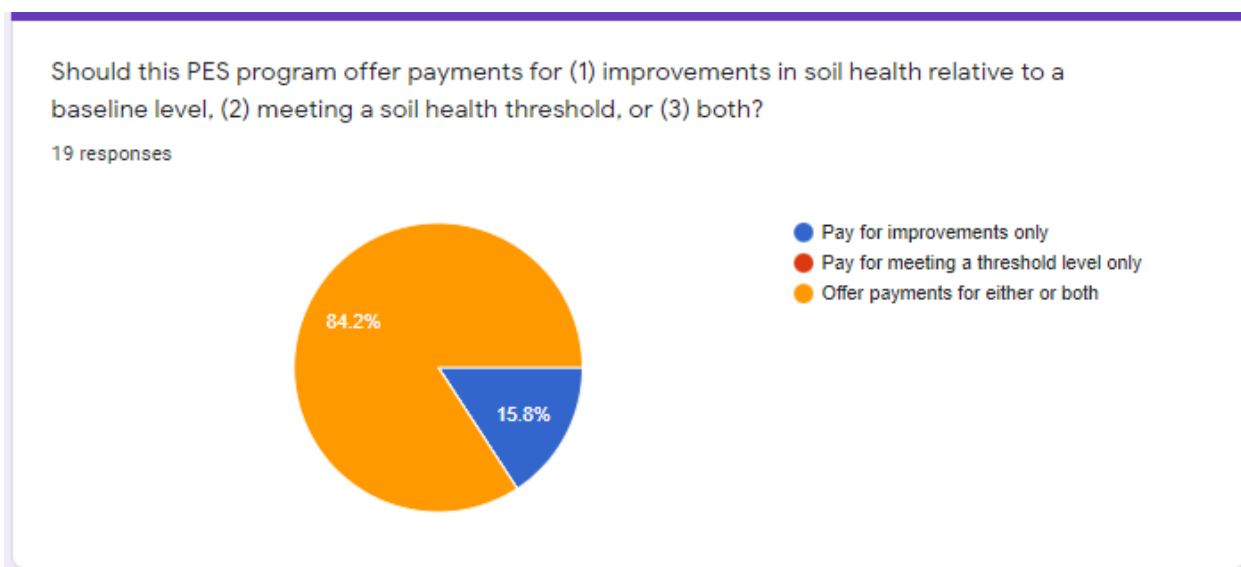
made such efforts. However, the cost-effectiveness of the PES program will be greatly diminished by paying for soil health that has already been delivered (i.e. non-additional). This is an ever-present policy issue that does not have a “right” and a “wrong” solution; it requires careful consideration of program goals, as well as current and future budget constraints.

From the first meetings of the PES Working Group in 2019, there has been a stated intention that the program be fair to farmers who have been early adopters of soil health practices. However, the Working Group also has some members who are very concerned about the potential cost of this new program relative to the available financial resources for it, if any. Further, a program that is paying farmers with public dollars, but is not securing “additional” ecosystem services could be hard to sell to the public. Ideally, this PES program will be both cost-effective and fair. The recommendations below are an attempt to meet both goals.

Working Group Input on Payment Structure

As can be seen in Figure 8 below, 84% of survey respondents indicated that offering both types of payments is preferable. In some situations, farmers could earn payments for both improvements and for meeting the threshold simultaneously. However, for higher soil health scores further improvements may become more difficult to achieve. The verbatim responses to the open-ended question on payment structure are shown in Appendix I.

Figure 8. Survey results on payment structure.



Recommendations on Payment Structure

The design of the program’s payment structure is the place where the additionality vs. fairness issue can most directly be addressed. We recommend:

1. The Working Group should consider a hybrid payment structure in which farmers could earn a payment for (1) measured improvements in soil health from their farm’s baseline, or (2) having a soil health score that is equal to or greater than a stated threshold. For the soil health improvement, the payment amount would be a function of the increase in soil health score, the payment rate per point, and the number of acres enrolled. For exceeding the threshold, the

payment amount would be a function of the number of acres and the payment rate per acre. Establishing a series of thresholds with an increasing payment rate per acre should be considered.

2. With regard to baselines:
 - a. The baseline used for improvement should be the soil health score at the time that the farm was enrolled in the program or at the previous program quantification for the farm, whichever was most recent. As such, if the program requires soil measurements from each field every three years, then the baseline for improvement would be reset every three years.
 - b. The concept of a baseline is not applicable to the threshold payments. At any given quantification period either the farm exceeds the threshold, or it does not.
3. The template for the weighted farm score (see quantification recommendations) can be used to calculate payments for either improvements or exceeding thresholds or both.
4. With regard to payment rates:
 - a. The payment rates for improvement should be set to be great enough to motivate most farmers to want to increase their weighted soil health score. The minimum end of the range of payment rates could be informed by the full economic costs to the farmer of making management changes to improve their soil health score. Refer to the Task 4 Summary Report for an evaluation of full economic costs. The maximum end of the range could be informed by the full social value of the resulting ecosystem services. Refer to the Task 5 Summary Report for an estimate of these social values. The chosen payment rate would lie somewhere within this rather large range and be dictated by the program goals and budget constraints.
 - b. The payment rates for exceeding soil health thresholds should be set to acknowledge the value of the benefits that maintaining healthy soils has for the public, but not be set so high that the program costs exceed available funding for it.
 - c. Setting appropriate payment rates will require research (and/or existing data) that can correlate changes in field management with improvements in soil health score and incorporate information on the costs of field management changes and benefits of improved soil health scores.
5. Including a public recognition component for farms that achieve the highest threshold of soil health. Such farmers could be recognized as a “soil health hero” and signage could indicate the resulting public benefits.

Monitoring and Verification

Background and Context

There are several aspects of monitoring and verification for a PES program that should be considered. These are addressed below and followed by some suggestions and recommendations.

Monitoring field management – Based on the adage that “the proof is in the pudding”, if this PES program is based on soil sampling and analysis, then it may not be necessary to also monitor field management. However, improved soil health will require improved field management and it may be beneficial for the program to collect information on existing and new field management. Collecting this information could help justify the program cost to the public and it would also help by providing information on which changes were most effective on which soils over time. This

information could be very valuable for participating farmers over time and help other farmers make informed decision on which practices to implement and where for the biggest impact. Management information could be voluntarily submitted by farmers for this purpose. It may not be necessary to monitor or verify field management practices, if the payments are not a direct function of the practices, as opposed to a function of the resulting soil health scores.

Verifying soil sampling protocol – For accuracy of soil measurements it is essential that soil sampling for each field be representative of that field. Farmers know very well where in each field the best soils are. It would be easy to take samples that over-represent those areas and thereby skew the field's soil health score. Most farmers would probably not do this, but self-sampling opens the door quite wide for biased soil samples. It is possible that each soil core in a sample can be geo-referenced to show its location and the distribution of core samples across a soils map of the field. However, the probability that all farmers will have access to this technology in the near term is low and it does not prevent the ability to cheat. An addition, it would take staff time to verify that samples were randomly collected or collected from representative locations.

Alternatively, using objective third parties to take the soil samples may be the best way to ensure representative sampling. However, this will add more cost to the program, whether paid for by the program or by participating farmers. It is possible that the efficiency of sampling done by trained professionals could reduce the overall costs of sampling. This could also help to assuage fears of cheating. Working group members have suggested a peer sampling program could lower costs by allowing participating farms to have their samples collected by another farmer, using the food safety program as a model.

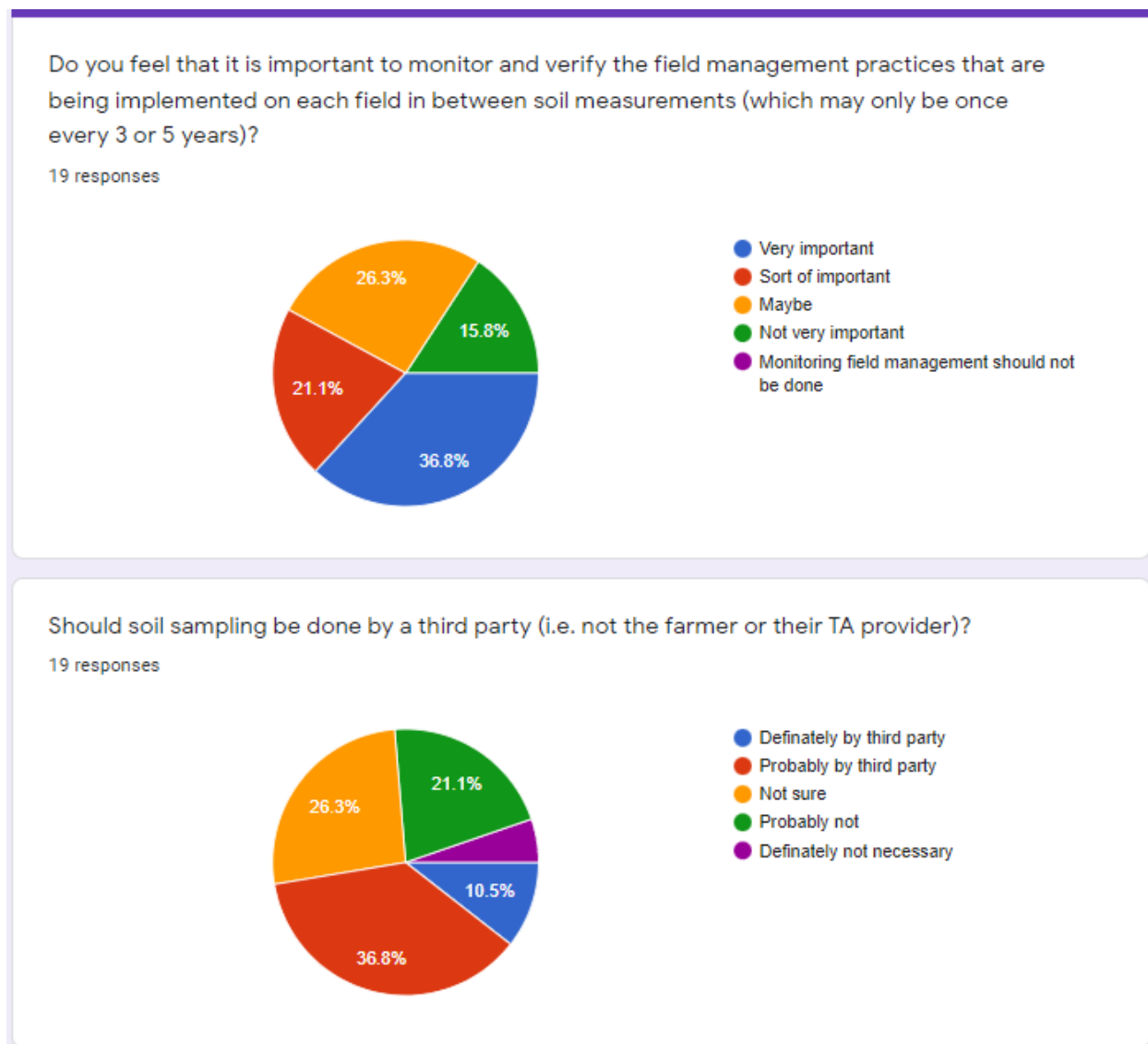
Verifying soil test results and CASH score calculations – It should not be necessary to verify lab results, as any trusted lab that the program chooses will most certainly provide objective results. The calculation of the modified CASH scores for each field will presumably be done by program staff and will be objective and correct. Double-checking results, calculations, and payments should be part of a quality assurance, quality control process for the program.

Working Group Input on Monitoring and Verification

As can be seen in Figure 9 below, there was a wide variety of perspectives on both monitoring of practices and third-party soil sampling. Over 57% of respondents thought monitoring of practices was either “very important” or “sort of important”. Over 26% indicated “maybe” and 16% indicated “not very important. No respondents indicated that this practice should not be done. In retrospect, it may have been better to ask this and other questions in the context of likely budget constraints faced by the program.

With regard to requirements on soil sampling, 47% indicated that it “definitely” or “probably” should be done by a third party. Just over 26% indicated “probably not” or “definitely not” and the remaining 26% were “not sure”. These results indicate that most lean toward third-party sampling, but also a smaller contingent lean away from it.

Figure 9. Survey results on monitoring and who does the soil sampling.



Recommendations on Monitoring and Verification

1. It is not recommended that the program monitor practices on enrolled fields, as this will increase the administrative costs of the program, thereby taking resources away from incentive payments. Since the quantification of soil health is based on soil measurements and not contingent on the practices used, the benefits of monitoring practices seem unlikely to justify the costs of doing so.
 - a. However, the PES program should make it as simple and easy as possible for farmers to voluntarily submit details on the practices implemented in each field over time. Although not used for monitoring, this information will allow the program to better understand the connection between practices and performance on various soil types and make this information (adequately aggregated) known to farmers throughout the state. It may be worth considering a small bonus payment to farmers who provide this information.

2. If the program budget allows for it, it may be valuable to have the program cover the cost of third-party soil sampling for all participating farmers. There are several reasons that we recommend this approach:
 - a. It may increase farmer participation in the program by making it easier for farmers to enroll.
 - b. It will likely result in more representative soil samples, as well as more consistency and fairness across the program.
 - c. It may be more efficient and cost-effective from an overall resource perspective to have trained personnel taking the soil samples because they will have the experience and equipment to get the sampling done relatively quickly.
 - d. It may enhance public support of the program by eliminating an obvious source of potential cheating.

Additional Issues of Relevance:

Program Administration

Background and Context

Two important administrative issues related to a program such as this are the selection of the implementing entity (i.e. responsible for program implementation and success) and the configuration of the program structure (i.e. components and dependencies). There are many possible configurations for administering a soil health PES program in Vermont. The questions that should be considered in such a decision include:

1. Is there adequate trust between farmers and the program administration to not hinder farmer participation in the program?
2. Are there “champions” in the administering body who are committed to seeing this PES program succeed?
3. Are there strong working relationships among the entities who are contributing to and/or responsible for the program’s success?

Regarding #1: Any PES program will require a certain amount of farm data to be shared with the program. Some farmers are leery of government and are reluctant to share any information that they think can be used against them under current or future regulation. Such concerns may be more prevalent for programs that are estimating P loss from the farm than for a soil health PES program. If compensation levels are adequate, farmers may be willing to participate and share data even if they harbor some distrust. However, all else being equal, the greater the level of trust by farmers of the program and its administration, the greater the level of farmer participation.

Regarding #2: If the implementation of this program is saddled on to an agency that does not want to administer it or does not have staff who are enthusiastic about it, the program may not get the attention and level of effort that are required to make it successful. A PES program, which has a level of complexity, could have a shared administration. This is addressed in the following point.

Regarding #3: An agri-environmental PES program should have the buy-in of the agricultural and the environmental communities. Bridging the historical divide between these two constituencies is a very important consideration that can help to secure resources for a new program. If there is shared

administrative responsibility for this program, it is important that there be good and functional working relationships between the two (or more) entities, starting at the highest levels, but also between the staff doing the work.

A recent USDA-funded Conservation Innovation Grants (CIG) project proposed the idea of a Vermont Soil Health Trust as a construct to advance soil health on Vermont farms. A summary of this idea is shown in Figure 10 below. The PES program being designed by the Working Group could fit into this structure under the “Outcomes Fund”. Instead of paying for carbon and for water quality, it could pay for soil health. However, if the program plans to sell carbon or water quality credits, it will need to quantify those outcomes specifically.

Recommendations on Program Administration

There has not been any significant discussion in the Working Group devoted to the issue of program administration to date. However, the program would benefit from co-design by the staff and agency that will administer the program. There are elements of program administration that are crucial for program success. The recommendations below address these elements.

1. Ensure that program administration and/or oversight has representation from both the farming and environmental communities.
2. Ensure that the entity and staff administering this PES program are enthusiastic about the program and optimistic or determined to achieve the program’s goals. Having a champion on point for program coordination is helpful.
3. Consider the pros and cons of implementing this PES program within a larger context such as that described above as the Vermont Soil Health Trust.

Program Costs and Potential Sources of Funding

Background and Context

As with program administration, there has not been a lot of focus yet on program costs. Some discussion of potential sources of funding has started and at the time of this report being drafted, the Governor’s proposed budget for FY23 included \$1 million for this program. A program needs to have an initial design before its costs can be estimated. However, clarity on the potential sources of funding, associated levels of funding, and probabilities can be helpful in tailoring the initial design toward something that is feasible.

An alternative approach is to create the initial program design without regard to funding sources and budget limitations. This represents an “if you build it, they will come” approach (from the movie *Field of Dreams*) and can be an instructive exercise, even if the reality of budget constraints ultimately requires significant paring. Discussion in the Working group have touched on both approaches.

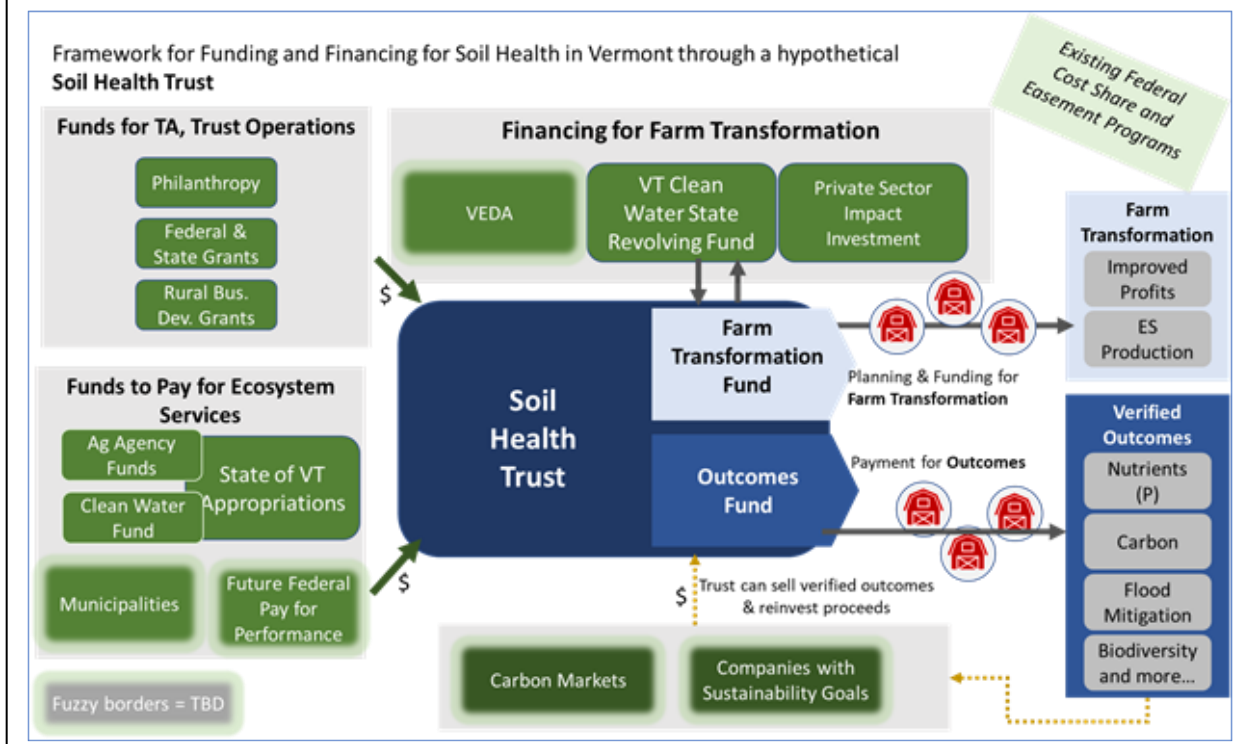
The general categories of costs to implement a PES program include (1) administrative costs, (2) incentive payments, and (3) quantification and verification costs. A program that can achieve its goals with lower administrative and quantification/verification costs will have more funds to devote to incentive payments, which are designed to motivate participation and change.

Figure 10. Conceptual framework for a VT Soil Health Trust; produced by a separate project.

Vermont Soil Health Trust - Summary

To help build and maintain a healthy farm sector in Vermont, the Trust would 1) provide the financial and technical support that farmers need to design and implement a pathway to regenerative agriculture and 2) facilitate ES payments to farmers for quantified environmental outcomes. To achieve both of these, the Trust would operate two related funds:

- **The Farm Transformation Fund** would provide interested farmers with the financial and technical assistance (TA) resources necessary to transform to regenerative agriculture. A TA team of agronomy, dairy/livestock, and farm finance experts would work with each farmer to develop a farm transformation plan. Each farm-specific plan would contain estimates of productivity and financial performance, as well as ES generation. Improved profitability and divestment of unnecessary equipment would free up cash for new investment, if needed. Debt restructuring may be necessary for some farms. The projected flow of ES could be used to determine financing terms and to justify public investment in the transformation.
- **The Outcomes Fund** would implement one or more pay-for-performance (PFP) programs that provide the framework, metrics, and tools to quantify the relevant ESs and pay farmers for what they produce. The Outcomes Fund would aggregate carbon and water quality credits and market them through all available channels. Revenue from credit sales would augment the Outcomes Fund to be able to reward more farmers for environmental outcomes.



The recent Soil Health Trust CIG project mentioned above also assessed potential funding sources for advancing a soil health PES program in Vermont. A report titled *“Funding and Financing Resources for Vermont Farmers Interested in All-in Soil Health and the Delivery of Ecosystem Services”* was completed in May 2021 and is available as a resource for this project. Figure 11 contains a brief summary from that report.

Figure 11. Potential funding and financing sources identified for Vermont Soil Health Trust.

Type of Funding	Program/Agency/Player
Funding for adopting Soil Health Practices	<ul style="list-style-type: none"> • Cost Share: USDA: EQIP, CSP, RCPP; AAFM: FAP, BMP, GWFS; RD: REAP. • Clean Water Fund Grants for Agriculture: VHCB Water Quality Grants, AAFM Capital Equipment Assistance Program • Water Quality Financing (Clean Water State Revolving Fund)
Direct Payments for Environmental Outcomes or Ecosystem Services	<ul style="list-style-type: none"> • Public Programs: RCPP PFP (Phosphorous Reduction), VT Environmental Stewardship Program • Private Programs (ESMC, Indigo Ag, Carbon Markets, Supply Chain Programs) • <i>Non-VT Case Study: Soil and Water Outcomes Fund (Iowa) and Brandywine-Christina (Chesapeake Bay)</i>
Financing for farm transformation to regenerative systems	<ul style="list-style-type: none"> • NGO's: High Meadows, Taproot, Castanea, VT Community Loan Fund • DBIC • VLT/Farmland Futures • USDA-FSA Conservation Contracts • Traditional financing (easements, FSA, Farm Credit, VEDA, VACC, WLEI loans) • <i>Non-VT Case Study: RePlant Capital</i>
Other sources of capital	<ul style="list-style-type: none"> • Rural Development Grants and Programs (Value-Added Producer Grants, Rural Business Development Grants)
Technical and Business Planning Assistance	<ul style="list-style-type: none"> • USDA, UVM Extension, VHCB, AAFM

Vermont Agriculture and Food System Plan 2021-2030 includes a Food System Financing Inventory. This is a listing of capital providers who help to finance farm and food businesses, including debt, equity, and royalty financing, as well as various grant programs. The inventory is a supplemental document to the Vermont Agriculture & Food System Strategic Plan 2021-2030 as requested by the Vermont Legislature as part of Act 83/S.160 (2019). It can be found [here](https://www.vtfarmtoplate.com/resources/food-system-financing-inventory). <https://www.vtfarmtoplate.com/resources/food-system-financing-inventory>.

Working Group Input on Potential Sources of Funding

To date, the only input on potential sources of funding solicited from the Working Group has been from staff of the Vermont Agency of Agriculture, Food, and Markets (AAFM) and the Vermont Housing and Conservation Board (VHCB) since they are more closely connected to the legislative process and state-level funding sources. Although there is no crystal ball to know what funding may be available for this PES program, the following has emerged.

1. Direct funding allocation for piloting this PES has been proposed in the Governor's FY23 budget at \$1 million, but is uncertain if it will be in the final budget.
2. It may be possible that funding from the state's [Clean Water Initiative](#) could be used for this program. Similarly, tapping into funds from the state's Water Quality bond should be investigated. Similarly, tapping into funds from the state's Water Quality bond should be investigated. Legislative changes may be required for use of these funding sources for this PES program.
 - a. Both of these would require establishing a very clear scientific link between the soil health metric used by the program (e.g. a modified CASH test score) and improved water quality, which has not yet been proved to be consistently correlated.
 - b. Most of the conservation practices that increase soil health are the same practices that are funded through water quality programs, such as EQIP, so there should be some correlation.
3. A significant amount of funding has been provided to the state through the American Rescue Plan Act (ARPA). It is possible that these funds could be tapped into for this PES program. However, ARPA funds are short-term and targeted more for infrastructure or job creation. As such, these funds are not likely to fit a soil health program.
4. There is funding being allocated to the implementation of the newly created Vermont Climate Action Plan. It has been suggested that the more clearly that the climate co-benefits of this PES program can be demonstrated, the more likely that a portion of the state's climate action funding could be used.

[Recommendations on Potential Sources of Funding](#)

The sources of funding for this need to be fully investigated once there is a draft program design. We recommend that the Working Group leadership form a funding subcommittee for this purpose. The subcommittee should include agency staff who are very familiar with the legislative and funding process in Montpelier, but it should also include at least one farmer and one person representing the environmental groups. These members will help convey the breadth of commitment and support that this program has.

[Assistance to Farmers – Technical and Financial](#)

[Background and Context](#)

Outcome-based programs benefit from farm-level planning and assessment to produce information that can aid in farmer decision-making related to field management to maximize benefits from the program. It would be very valuable for participating farmers who are trying to improve their soil health scores to achieve a higher threshold to receive technical assistance and information for decision-making. However, staff time is expensive and can drive up the total program costs quite quickly.

TA resources can be found in Vermont within federal and state agencies, UVM Extension, Conservation Districts, and in the private sector, but it seems that TA resources are tighter than they have been in the past. Even if TA is provided by an agency at no cost to the PES program, all staff time has a cost and needs to be accounted for in the total economic cost of the program.

Financial assistance, in addition to the outcome-based payments earned by farmers through the program, can take the form of cost-share or other program payments for conservation practices from federal and/or state sources. USDA policy allows farmers to sell environmental outcomes (e.g. carbon

and/or water quality credits) even if they have received practice-based payments for implementing conservation that resulted in the environmental outcome. Similarly, cost-share funding from existing programs should be encouraged to help farmers improve soil health and allow them to benefit from this PES program.

Working Group Input on Technical and Financial Assistance

Relative to the current amount of technical and financial assistance available to Vermont farmers, our survey asked Working Group respondents to indicate if they felt extra technical and extra financial assistance should be made available to farmers who participate in this PES program to help improve soil health on their farms. As can be seen in Figure 12, over 94% of respondents indicated that additional technical and financial assistance should be made available to PES program participants. This result is not surprising.

Figure 12 Survey results on supplying additional technical and financial assistance to participating farmers.



Recommendations on Technical and Financial Assistance

Additional technical and financial assistance are a function of available resources, which change over time and cannot be fully known in advance. At this early stage, what can be said is that more help to farmers to improve their soil health is consistent with the PES program goals and would be advantageous. Encouraging interested farmers to take full advantage of related cost-share programs could help boost their soil health scores in this program.

Program Evaluation and Adaptive Management

It is important that the evaluation of a program be carefully considered during its design. Successful evaluation is essential for program improvement over time, which is enabled through an adaptive management approach. This is another reason why clear and specific program goals and objectives are essential. The evaluation should be able to indicate not only if the program's implementation is working well, but if it is meeting its goals and objectives.

Key performance indicators need to be identified during the design process and continuous or periodic data collection of required variables is necessary. The types of variables that are likely to be useful for the evaluation include farmer satisfaction, staff time (including sampling and technical assistance) required, administrative costs, farmer payments (for both improvements and meeting thresholds), as well as all the soil health metrics and estimates of the ecosystem services produced. Going through the exercise of creating an evaluation report before the program is launched can be extremely useful to identify the specific information needed and how best to collect it.

Using an evaluation specialist during the design process can pay dividends for the program by creating efficiencies in data collection, analysis, and reporting. This can be invaluable for a new public-funded program that needs to justify its impact and cost-effectiveness to legislators and the public. Additionally, designing an adaptive management process that utilizes the results of each evaluation to modify the program and/or its delivery is necessary to ensure improvement over time.

Suggested Next Steps

A summary of this report including the recommendations are provided in the Executive Summary. This section provides a brief description of the suggested next steps for the Working Group to effectively and successfully design a soil health PES program for Vermont.

1. **Articulate clear goals and specific objectives** for this PES program. Clearly stated goals and objectives will be of critical importance in making decisions about specific program design issues. As choices need to be made by the Working Group, each alternative can be evaluated based on how well it will help to meet the goals and objectives of the program.
2. **Create a program design subcommittee** tasked with pushing the design process forward. The full Working Group is probably too large to effectively and efficiently dig into the plethora of details and decisions that are required for a program as complex as this one. This subcommittee should include Working Group members who represent the differing perspectives on issues such as the inclusion of biodiversity and holistic management, as well as the cost of the program and perceived budget constraints. It should also include staff who are likely to be involved with or responsible for program implementation.

3. **Enlist a program evaluation specialist** into the program design process. Specifying exactly how the program will be evaluated and determining its critical success factors as part of the design process will result in a stronger program with a much greater likelihood of success.
4. **Create a program funding subcommittee** to inventory and assess the potential funding sources for this specific PES program. Information generated by this subcommittee will be very useful in determining if the program being designed is financially feasible or not.
5. **Assemble a team of Vermont soil scientists and others** to suggest modifications of the CASH tool for use by this PES program. It is fairly clear that (1) the CASH test may be the best basis for quantifying soil health in this program, and (2) that the CASH test will need some modifications to be effectively used for a program like this in Vermont. Getting started on these modifications as soon as possible will help the program design process.
6. **Seek resources to advance research** that (1) correlates field management (and changes thereto) with soil health scores and (2) calculates the full economic costs to the farmer. A greater understanding of which types of field management is most effective at increasing soil health scores on which soil types and at what cost will provide important information for farmers across the state. This information will help farmers to find the most cost-effective ways to improve their soil health performance.

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Appendix I – Verbatim Responses to Survey Questions

Verbatim responses related to the question: *If you have any other input related to eligibility, please state it below.*

I think a farmer should be able to start out by enrolling individual fields with the goal of enrolling the whole farm, maybe by X year to encourage whole farm ecological health.

Participation in in baseline soil testing

Any landowner should be able to enter into the program for any amount of acreage. I'd like to see continued participation require more acreage added each year until the whole farm/forest/orchard is included. Whole farms that are participants, no matter the size, should receive an annual base income for their service to society. Additional financial incentives should pay for practices to implement and reward for performance on an annual basis. Practices that do not yield desired performance should not cost the land manager money nor should performance rewards be administered.

I don't have a response to this question at this time. I haven't thought a lot about this specific question or talked about it with farmers. An immediate thought is that allowing a farm to choose some fields and not others may not necessarily reflect their management - rather the state of the field at that point in time given whatever history of management has or has not occurred on it... this seems selective, and to favor farms with more land to pick and choose from. If we are wanting to ensure that farms (as full entities) are improving their practices / outcomes, etc. - then it would seem to me that we may want to look at the entire amount of land being managed (and potentially other costs not directly seen on the land / in the soils: pesticide manufacture and usage, transportation and supply chain, habitat connectivity, etc.).

1) For an outcomes based program that does not prescribe practices and emphasizes farmer autonomy and ingenuity, I think a whole farm requirement would be prohibitive for farmers who want to test out new approaches without making an experiment of their entire farm (I'm not sure this would matter in a practice based program as much because it would be less experimental), 2) Diversified farms might want to enroll some management areas of their farm, but not all (ie, someone producing both beef and vegetables my want to enroll their pastureland but not vegetable fields. I had a similar experience working on a farm that produced mixed livestock and had a vegetable csa--it made sense to certify the vegetables, so we did, but we would have lost money certifying the livestock, so we would not have been able to certify the vegetable CSA organic if we were required to certify the entire farm.), 3) regarding the concern that a farmer who can enroll individual fields may exploit unenrolled fields to balance costs lost for enrolling other fields, I'd like to draw attention to the approach of the CSP+ program--in the proposal, we hadn't settled on whether a farm would be able to enroll only individual fields or not. However, one thing we discussed when drafting that proposal was that the main emphasis of the CSP+ is the comprehensive planning element with TSP. In this approach, its possible a farmer could only enroll some fields on which to sell services, but the comprehensive plan could account for the entire farm to ensure that services weren't being produced in some areas at the expense of others. 4) several people have raised the concern about how to handle leased land

for whole-farm enrollment. The main program I recall from the Task 6 review that considered that problem was the Glastir program in Wales, and you can find their enrollment requirements here at page 5: <https://gov.wales/sites/default/files/publications/2018-01/glastir-entry-2015-rules-booklet-1.pdf>

My other input would be "it depends" on individual situations. Sorry for the confusion!

Concerns with making improvements in one area could be negated on other farm lands

I feel it would be too limiting to require farmers to enroll their entire farm, so I am in favor of allowing enrollment of individual fields.

Checked "no" above because I am an advocate for a holistic approach wherein participating land managers would undertake Soil Health Management Systems to transform all practices on the farm towards the goal of carbon farming and maximizing restoration of landscape function and biodiversity.

There has to be a lower limit on acreage or that true agriculture being practiced on the property

I believe that the whole farm approach should be used

I would be hesitant to enroll land that may be rented on an annual basis, and would rather invest inputs into owned land, or land that has a longer term lease. This is especially important if the payout is based on farm average. In another scenario, a sandy field might not do very well across a farm average. While it can still be managed quite well, I am not sure how the proposed metrics would rank it. Until we get some ground truthing done, the per field basis seems less risky to the farmer. I am wondering what the term commercial means? I think it is anyone selling goods? May need to define a field, I'd say tree farms could be eligible, if they were cultivated/planted. I would not be apposed to this as they seem to meet the programs objective and allow for some creative approaches to rank well.

Verbatim responses to the question on quantification: *If you have other suggestions for how to quantify soil health, please explain them below. Other options could be (1) estimating soil health based on field management practices or (2) some type of simulation modeling.*

It seems like this may not be a single solution situation. For properties of soil health that can be accurately and affordably measured, especially by farmers themselves, we should do that. Ideally we can help support some research that could help more accurately calibrate farmers' field observations to specific outcomes so that the easily accomplished, on-farm tests and observations farmers conduct can be reliably extrapolated to tell us what is being accomplished.

Bear in mind how long it can take for soil health changes to manifest after a grower changes practices (sometimes 3-5 years)

I see the value of soil measurements and like the idea of a VT-type CASH test but would like to find a way to monitor changes over time that yield a whole systems perspective to include increased biodiversity in flora and fauna, increased water infiltration and holding capacity, improved wetlands, reduced pest/pathogen pressure, reduced off-farm inputs, reduced run-off and erosion...

This depends on what is being measured, how it's being measured, etc. I think there needs to be a combination of direct measurement (ideally at a substantially greater depth than 30cm - or measures to greater depth in addition), as well as assessments of outcomes based on management practices, and potentially some modelling (for example, a 30cm soil core is not going to tell the story of how the canopy of agroforestry plantings slow rainfall or increase transpiration, or even how the roots of the trees, shrubs, and perennial forages affect soil qualities to a reasonable depth, or the increased habitat these multiple horizons bring; a 30cm soil core is not necessarily going to tell the full story of a biodiverse well grazed pasture with a high residual and how that transpires, slows water movement across the landscape, provides more habitat, etc.). This is a case of "both / and" vs. "either / or" to me. We want to be accounting for and encouraging the most progressive and impactful practices which help the greatest number of farmers, and their human and non-human communities - and we need to be able to meet people where they are to get there.

Is there a reliable and economic option? Practices can't be a measurement, only a first, logical step toward a measurable goal.

Quantification is an important first step. Modeling can be calibrated based on extensive measuring and quantification. Estimating soil health based on field management practices can be vague and inaccurate

Best determined by agronomists but prefer over modeling. Only other consideration should be looking at the field mgmt practices -we are already tracking so many of those for P reductions that it would be far more efficient to track for soil health improvement as well (and for ghg reductions)

It is not practical to measure carbon sequestration, water quality and other enhanced functions on every farm every year. Therefore UVM should continue to conduct trials and monitor pilot farms to establish median averages resulting from the implementation of soil health plans. Farmers will be expected to document practices. Because of the many variables of farm context, and the long-standing adverse economic environment for farmers in general, I am an advocate for upfront rewards for adoption of healthy soil practices, which may be augmented upon regular demonstration of quantifiable results of said practices. Soil health can also be measured in observation of yield and keeping quality of produce, health and balanced production of livestock, levels of landscape functionality and biodiversity on farm.

I think measurement over time is critical. I think crop yield/ crop health and farmer observation are important. I also think the health of pollinators, beneficial insects, birds, microbes, soil arthropods, etc. are also important indicators of soil health. Hard to measure but I think worth trying to capture somehow here. I would be curious to learn what option #1 above looks like.

Management History/Nutrient management combined with comprehensive soil "health" quantification in real time, not just modeling.

Modeling preferred

The soil test seems to be the most accurate, efficient way and it covers a lot of the discussion points that group has had since its inception. I like the simplicity. I like that I could potentially

enter the data in GIS software to create a heat map, and see how its impacting other data sets, or how those maps are impacting the soil health map. This is an area were funding outcome rather than practices becomes incentive to do a better job with practice.

Plant health, biodiversity (insects, birds), nutrient density of crops all also good.

Verbatim responses to the question on use other quantification tools: *Are there other tools or means for quantifying soil health that you want to suggest? Please explain your suggestion with some details..*

I think CASH, plus some additions would work well

increased biodiversity in flora and fauna: species counts using gps, a transect grid, simple observation hoop and a pencil. Great to partner with schools, citizen scientists or youth groups

increased water infiltration and holding capacity: I understand that bulk density and SOM are indicators. Using transects and infiltration rings on site is telling.

improved wetlands: upland and lowland, livestock exclusion zones, incentives to bring back beavers, uphill swales, riparian buffers, and other agroforestry practices

reduced pest/pathogen pressure: leaf analysis, nutrient availability, soil and whole plant microbial diversity

reduced off-farm inputs: incentivize making compost, compost teas, plant-based foliar sprays, cover cropping

reduced run-off and erosion: take photos in spring and fall, measure water quality downstream

There are traditional tools of observation and relationship for judging the ecological values and outcomes on a landscape as well which are used by farmers, service providers, particular programs, and others such as: diversity of species present, presence of a diversity of horizons of habitat (pasture, shrub, water surface, tree, pollination), length of residual remaining after haying or grazing, rest period length in grazing between rotations (in relationship to greater grazing plan, etc.), presence of trees and woody shrubs appropriately managed in a pasture landscape, amount of land with intensive soil disturbance and land left without effective soil cover, very short farm-table "footprint", solid manure management vs. liquid manure management, etc. I think that many of these broader pattern and outcome observations are important, as they speak to a diversity of outcomes which soil measurements may not and may not take into account: from habitat and hydrological cycles, to slowing the movement of water across the surface of a pasture, to emissions considerations.

Via quantifying soil microorganisms, soil respiration, structure, infiltration, aggregate stability, bulk density, etc.

yes above with the caveat of the adjusted curves. But defer to agronomists

Working with a TSP advisor (or team) land managers can record and demonstrate how the 5 principles of soil health (developed by the NRCS----6 if you count context) are being applied in all aspects of land management. For instance, a market gardener uses a combination of mulching materials, cash crops, and cover crops to ensure that soil is "armored" at all times. If the land

manager is enrolled in a Soil Health Management System (could be CSP+) the onus on will be to keep records on how principles are being translated into practice according to the specific farm plan. This would be a master plan subject to revision and similar, but more ambitious in scope, to a Nutrient Management Plan.

As above--I think tracking yield and crop health over time is an important indicator of soil health (and aligns with a farmer goals).

Biological Diversity & numbers. Fungi is important too! Also consider at what depth in the soil profile you are measuring & quantifying.

CASH alone does not get to all the data I believe is needed and desired

Verbatim responses related to payment structure: *If you have any other input related to payment structure, please state it below.*

My answers to the last two questions are based on a limitless budgets scenario. There are a lot of practice-based programs that can help farms make the changes they need to improve soils health. And of course we'd love to have more TA for all farms.

I left both blank, because I'm not sure. The single test seems pretty simple. I think if the payout rate is adjusted to reflect the work being done and the the cost of the sample data, then there would be money to hire services or keep additional funds on the farm. The question with this approach becomes are there enough private means to get this done. Some public employees, do not do much boots on the ground work, and i have heard at our meetings that there is some desire to be in the office less and out in the field more. This would seem to be a healthy transition for those staff members. Adding it to the payout structure also adds an element of accountability, as you will want to recoup your own expenses. Perhaps there could be some incentive for the initial round of samples, so participation does not become limited by the inability to get started.

Figure a way to make use of all the tools that are available today, enhance them.

Farmers and land managers that are serious about committing their land toward an investment in service to ecosystems should be guaranteed a universal base income that meets a livable wage.

I said yes to all above because it would be great, but I have serious concerns of where all this money is going to come from. I don't believe there is the political or public will to support this to the extent necessary to fund it effectively.

Shift subsidies away from "failing" enterprises to encourage more rapid change in management practices.

Would be interesting to get VEDA/VACC involved with a lending option to assist farmers in making changes as long as the TSP and farmer can demonstrate it's for the better of the farm and environment.

How do you reward farmers who have been doing soil health practices all along, resulting in healthy soils with high organic matter percentages? Farmers who have led the way by being

proactive in all segments of their agricultural endeavors, whether in soil health or animal health management.

Soil Health Management Systems would allow for the land manager to apply for assistance on a variety of practices under a single contract. This would increase enrollment and voluntary compliance with Required Agricultural Practices (existing and yet to come). Incentives are a favorable approach over regulations. Successful pilot projects and farmer-to-farmer training are proven methods for accelerating the adoption of healthy soils practices among the legacy farming community. Qualifying farmers should be enlisted as TSP staffers.

Each land manager would have a “team” of experts to help implement and troubleshoot. This team could coordinate with the Farm Viability Program to strive for successful outcomes at every level. Site characteristics and social context will be taken into account to ensure an equitable and just transition toward organic regenerative management. The aim is to ensure that land managers (and their employees) who adopt healthy soil practices are guaranteed a living wage.

Currently Addison Chittenden Counties are losing two vital Extension personnel

I think that more technical assistance on farms is helpful in general, and in relationship to this program it would be important for TSPs to be informed about it in order to be able to support folks in applying / participating. Depending on how the program looks, these questions may have different responses from me. If this program is based around a farm joining a program in which it develops a personalized plan for ecological improvement and that is guided by a relationship with a TSP over a few years of contract - then yes, there may be the need for increased technical assistance. If folks enrolled in a program fall between the cracks of other federally or State available funding, then there may also be the need for increased financial assistance. I would also consider the work done for the VT Strategic Ag Plan related to TSP needs, and to folks who currently are TSPs and who administer grants and funds for assistance. These folks have a lived understanding of current capacity and program dynamics.

I think this would go along well with a state bank system. A great thing for the state to invest in.

Verbatim responses to the question on biodiversity: Please describe any further thoughts you may have on including a certain type(s) of biodiversity into the PES program. If you selected more than one option above, please describe the order of importance. Also, please consider your thoughts on how to quantify and the cost-benefit ratio of measuring the type(s) of biodiversity that you selected above.

I think Soil macroinvertebrates is the most important as it usually is indicative of the presence of other metrics

Soil microbial #1 and Plant diversity #2

I understand it may not be practical initially to include biodiversity metrics across all the levels listed above. However, I feel strongly that in order to create a program that truly steers us in the direction of ecological health, biodiversity needs to be a focus. Focusing too narrowly on soil

health measured in a given field will not necessarily lead to resilient farming systems or ecosystems.

All types included, but ranked as listed

It's not up to us to decide what species are more important than others. All species have intrinsic value in a system, whether or not they are being counted or valued or protected by humans.

Plant diversity and wildlife habitat both have many benefits and there are accessible tools to measure them (also could be directly observable). Regarding soil biodiversity: I am not a soil scientist, but as I understand it soil biodiversity is ephemeral and fairly inconsistent even within a single location, which I think would make it difficult to take accurate measurements.

I think the big picture is incredibly important--so prioritizing habitat and less disturbed areas like wetlands, forests, etc. Field edges are also important, providing habitat for birds, pollinators, beneficials, etc. I think the more minute measurables are more costly--very important but I feel like it's all connected, and addressing the whole farm system will support the less visible soil indicators.

Very difficult to choose, generally soil first, plant second and wildlife next. In the belief that plant diversity will help with wildlife diversity.

The Payment for Ecosystem Service and Soil Health Working Group is charged to build a PES program to support and enhance soil health on farms. Where a metric of soil health can include representative measurement of the health of the soil, soil microbial diversity and the presence of macroinvertebrates can help support the quantification of this soil health goal.

The IPCC has stated that loss of biodiversity is an equal or greater existential threat as climate change. Ag monitoring should start with soil but embrace whole landscape function.

I think habitat is the outcome that best matches the group's interest

Tree and Shrub plantings upstream, along field edges. Reintroducing native species that had been eroded from the landscape, that layer between economic benefit of land use lies between field and forest on the edge and maybe even in between. It does benefit, by establishing root systems, different for the large trees and short grasses, that suck up the water in other layers and pores of the soil and helping to stabilize the same. To secure the soil from increasingly heavy rainfalls that already show signs of erosion in the mountains, beginning to mark future brooks that bound their streams to the surface waters of the state. In the meantime, investing in the diversity of shrubs, including fruit and nut bearing trees promises an increase in local harvests of nourishing foods for the entire food chain.

Verbatim responses to the question on conservation effort and payment rate: *Please add any further thoughts you may have on the conservation effort required or the payment level that you would like to see in this program.*

I really need more information to answer the question about payment above. It would be helpful to see some data on how much it costs farmers on average to implement these practices, and to have more focused discussion on the question of valuation so we understand all the factors that go into developing payment rates.

In a pasture system, it's not about exactly how many days on pasture. They need to show they are using a holistic management approach to decision making, having completed a course and participating in an ongoing community of practice or "support group," and have a grazing plan that includes monitoring and adaptation based on how fast plants are regrowing, how much of plant animals are taking in how long. etc.

These questions are a little too limited and leading.

Last question is very complex. Funding could be coming from saved state and local costs on water cleanup, culvert and road rebuilds, private costs of air conditioning, public health/immunity, etc. etc. as well as external funding from carbon offsets etc.

I'd really like to include the whole farm ecosystem into this program. Also many of the questions vary depending on farm type--as should payment structure probably. Most diversified vegetable farms are >50 acres, but should still be incentivized to participate in this program, and have a lot of improvements needed to support Ecosystem services. Very different from field crops or hay fields in terms of practice adjustments and payment incentives.

I think a crop rotating would work well, I also think grain crops that leave a lot of biomass would do well. Since we are measuring the soil, it should not matter what practices we think are important. The pay rate will never be perfect, but it does need to compensate for the additional time required to participate and act as a worthwhile reward for the achievement, not necessarily cover every single practice to produce the results. If the administrative part is simple, I can see the state getting more participation at a lower rate.

Some of these questions are hard to be definitive about because so much depends on the farm circumstances and the level of management.

If the goal of the program is to compensate for performance outcomes, dictating the number of practices that need to be implemented seems counterintuitive for quantifying and compensating for performance. As it relates to a payment per acre, farmers are delivering uncompensated ES benefits that likely far exceed \$200 per unit; and when compared to the value of the land and increasing development pressure, providing an equitable payment could likely exceed \$200/acre/year.

Depending on where is the source of funding and for how long will it be available, can we make some of the payments as cost sharing instead of full payments covering the costs of practice adoptions? I guess I am coming from a standpoint where we may not have all the funding needed, and I think it is necessary to enroll as many farmers as possible rather than just a few fully funded. Thanks!

My answers were based on assuming this survey is clarifying base level requirements for enrollment---with the hope for deeper engagement with whole farm planning----and payment based on adoption of a Soil Health Management System.

This survey is based on a problematic assumption that practices lead to outcomes, when we see that empirical research indicates this is not always the case. It is not just about practices.

Current use pays more than \$300 per acre simply for the agricultural use - PES has to be the premium tier of payments per acre in comparison.

Verbatim responses to the question on monitoring and verification: *If you have any other input related to monitoring and verification, please state it below.*

In the early stages in program it probably would be good to offer some TA and verify field management strategies.

Too much third party would be very expensive. However there needs to be some sort of verification to ensure the integrity of the program

The time it takes farmers and land managers to perform tests is extractive. If a farmer wants to do their own testing they should be paid to do so.

Essential if there is any hope for public/political support

I think it should definitely be done by a third party to ensure the program's credibility. But looking back to my prior comment about making sure funding is channeled to those people/organizations that are the focus of the program's objective, we should select that third party carefully and prioritize hiring other farmers, or VT-based TSP, etc., to do the sampling.

There should at least be some kind of third party verification system. Its important to avoid history repeating itself.

Third party soil sampling will guarantee honest results and can and probably should be cost shared. It will go into a state/ national database and is very valuable information. Most farmers don't even have time to take the tests accurately.

Regards soil sampling, it is important for equitable and realistic results, that the type of testing be universal across the board, using the same class of test and methodology for measurement on every farm.

How it is appropriately monitored and verified depends on the program - how its structured around incentives / payments / etc. for practices and / or outcomes in particular. Sure, there is some incentive for farmers to selectively choose particular soils for sampling - and potentially TA providers - but I would imagine that kind of behavior to be very minimal. Some degree of monitoring and verification would go a ways towards ensuring honesty and transparency (and accuracy and understanding of the program and testing / monitoring needed from the farmer). I think that these requirements for monitoring could potentially be tiered based on scale of operation, and other factors. Perhaps there could be some sort of peer monitoring? Somethings are also already tracked and monitored in NMPs and perhaps that overlap could have some benefits for a new program. If the program were centered on a longer term relationship with a

TA provider and program through a multi-year contract, with a baseline payment and tiers on top (as CSP plus for example suggest), then monitoring would be ongoing and accountability very present.

Developing an estimated budget for the desired level of monitoring will be important in weighing the cost-benefit of payment for performance vs. practice.

I can see reasons for farmer testing (they learn more) but also for having a verifier come on occasion. If it's based on outcomes, and not a practice based system then verification of practices not needed.

Respondent Information

Verbatim response to the question: *Please feel free to provide any additional input or suggestions that you may have related to the design of this soil health PES program.*

Thanks for all your great work on this.

Thanks for your Efforts, this is starting to take shape, after months (years) of slowness. However the thought process was needed to get to this point. In the end it looks like simplicity may take the place of lots of complex discussions.

It needs to be clear and understandable not only to farmers, but also to the public (especially critics). Honesty and integrity are at the top of the list to show the public that the program either is or is not doing as designed.

Just reiterating my serious concerns with the cost of this program. That should be discussed.

I believe it is imperative to remain cognizant of the larger context in which this design work occurs. Mainstream climate scientists are shouting from the rooftops that we have maybe a 3-5 year window in which to mitigate the worst effects of irreversible abrupt climate change. To meet our binding greenhouse gas emission reduction targets as established under the passage of the VT Global Warming Solutions Act, to clean up our rivers and lakes, and renew our agricultural economy, we need to elevate healthy soil as an essential ingredient to solve the climate and ecological crisis. Simply reducing GHG emissions won't be enough to halt climate change. We need to maximize the sequestration capacity of our farms and forests. More importantly, we need to focus on habitat restoration, maximizing landscape function, and restoring biodiversity.

Land managers need to be trained and supported to do this work. We must uncouple organic-regenerative farming from the capitalist system, or at least provide sufficient safety nets to guarantee a living wage for all farmers and farm workers engaged in organic regenerative land management.

Abrupt climate change is the symptom of the fundamental rupture from nature of settlement and colonialist culture. We can't expect farmers to focus on ecological services while they have to compete to survive in the industrial global food market. We need many more young people to work in regenerative organic land management as farmers and foresters. We must provide

training and a viable career path for this fundamentally vital work of healing land and feeding local communities.

I feel strongly that our PES program should include biodiversity as a core ecosystem service for which farmers can be compensated. Without including biodiversity as central to this program design (both below and above ground), I'm very concerned that we will create a program that sets us further down a path of mono-cropping, consolidation, damage from chemical inputs, and ultimately a brittle system of agriculture that is not resilient to climate or economic instability.